0'16R

Site Missouri Elec Works
ID # MOD980965982
Break: 5.0
Other: 002
SRC 9-28-05

RECORD OF DECISION

MISSOURI ELECTRIC WORKS SITE

CAPE GIRARDEAU, MISSOURI

Prepared By:

U.S. Environmental Protection Agency

Region VII

Kansas City, Kansas

September 2005

LIST OF ACRONYMS AND ABBREVIATIONS

1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichlorothene
1,2,4-TCB	1,2,4-trichlorobenzene
1,2-DCB	1,2-dichlorobenzene
1,2-DCE	1,2 dichloroethane
1,3-DCB	1,3-dichlorobenzene
1,4-DCB	1,4-dichlorobenzene
AL	Alluvium
AR	Administrative record
ARAR	Applicable or Relevant and Appropriate Requirements
ASL	Above sea level
bgs	Below ground surface
BH	Borehole
BHHRA	Baseline Human Health Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Chemical of concern
COPC	Chemicals of potential concern
CSF	Cancer slope factor
DOJ	Department of Justice
DRE	Destruction Removal Efficiency
EBD	Enhanced bio-degradation
EPA	Environmental Protection Agency
FB	Fractured bedrock
GFS	Fractured Bedrock and Alluvium Groundwater Feasibility Study
GRI	Groundwater Remedial Investigation
GTARC	Groundwater target concentrations
HI	Hazard Index
HW-A	Hypothetical well A
HW-B	Hypothetical well B
HW-C	Hypothetical well C
HW-D	Hypothetical well D
IC	Institutional control
ICLR	Incremental lifetime cancer risk
MCL	Maximum Concentration Level
MDL	Method detection limit
MDNR	Missouri Department of Natural Resources
MEW	Missouri Electric Works
MEWSC	Missouri Electric Works Steering Committee
MEWSTD	Missouri Electric Works Site Trust Donors
mg/kg-d	Milligram per kilogram of body weight per day
MNA	Monitored natural attenuation
MW	Monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ACRONYMS AND ABBREVIATIONS

NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	Operable Unit
OU 1	Soils operable unit
PCB	Polychlorinated biphenyls
PIC	Product of incomplete combustion
POTW	Publicly Owned Treatment Works
ppb	Parts per billion
ppm	Parts per million
PRG	Preliminary remediation goal
RA	Remedial Action
RAO	Remedial action objective
RfD	Reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting limits
ROD	Record of Decision
Source Area 1	Area surrounding monitoring wells MW-3, MW-5, MW-11 and MW-11A
Source Area 2	Former transformer storage and debris disposal areas
SVOC	Semi-volatile Organic Compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	Trichloroethene
TCL	Target cleanup levels
TEQ	TCDD equivalents
TI	Technical Impracticability
TI	Technical Impracticability
TSCA	Toxic Substances Control Act
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WES	Williams Environmental Services
WQS	Water Quality Standards

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PART I THE DECLARATION

1.1 Site Name and Location

Missouri Electric Works Site
MOD980965982
Operable Unit 2 (OU 2): Groundwater
Cape Girardeau, Missouri

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected remedies for the Missouri Electric Works (MEW) Superfund Site, OU 2, located in Cape Girardeau, Missouri. The remedial alternatives for the Site were presented in a Proposed Plan which was issued by the Environmental Protection Agency (EPA) in August 2005. The selected remedies were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and are based on the Administrative Record file for the Site.

The state of Missouri, acting through the Missouri Department of Natural Resources (MDNR), concurs with the selected remedies.

1.3 Assessment of Site

The selected remedies presented in this ROD are necessary to protect public health and the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of Selected Remedies

The remedial actions for OU 2 address contaminated groundwater in the fractured bedrock and in the alluvium. Contaminants detected in the fractured bedrock include: 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), tetrachloroethene (PCE), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethene (1,2-DCE), benzene, chlorobenzene, 1,2,4-trichlorobenzene (1,2,4-TCB), 1,2-dichlorobenzene (1,2-DCB), 1,3-dichlorobenzene (1,3-DCB), 1,4-dichlorobenzene (1,4-DCB), and polychlorinated biphenyls (PCBs) (water samples not filtered). Contaminants detected in the alluvium include: TCE, 1,4-dichloroethane (1,4-DCA), 1,1-DCE, 1,2-DCE, and 1,4-DCB. The remedial actions selected to address these two areas of contamination are summarized below.

Fractured Bedrock Groundwater - The remedial action selected to address contamination in the fractured bedrock groundwater (this action was designated in the Proposed Plan as Alternative FB-2), consists of the following four (4) components: technical impracticability (TI) waiver for attainment of chemical-specific applicable or relevant and appropriate requirements (ARARs), institutional controls (ICs), wellhead treatment, and long-term groundwater monitoring. The chemical-specific ARARs which are being waived by the TI waiver are identified in Section 9.1.2 of the Decision Summary. The ICs will be implemented to reduce the potential for exposure to the contaminated groundwater. The primary IC is expected to be proprietary in nature, i.e., a restrictive covenant and grant of access. Other ICs that might be used include the designation of the area of groundwater contamination as a "special use" area by MDNR's Division of Environmental Quality, the use of ordinances, inspection regimes, property notices, and/or public information. The ICs are discussed in Section 9.1.2, pages 30 and 31 of the Decision Summary.

Wellhead treatment systems, such as activated carbon or air strippers, that remove chemicals of concern (COCs) from the drinking water supply will be used. These systems could be installed and maintained for any existing potable (drinking) water supply well in the event that it becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could reasonably be expected to have COCs could also have wellhead treatment systems installed.

Monitoring of groundwater will be performed. This will be accomplished by obtaining groundwater samples from bedrock wells and performing laboratory analysis on the samples for COCs. Laboratory analysis for the duration of the monitoring is expected to include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and PCBs. Annual maintenance and repair of the monitoring wells will be required. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the remedial action objectives (RAOs) were met or a determination was made that monitoring was no longer necessary.

This remedial action provides for the overall protection of human health and the environment, a "threshold" criterion for remedy selection, as set forth in section 300.430(f) of the NCP, however, it does not meet the second NCP threshold criterion of compliance with ARARs. Due to the highly complex and variable bedrock conditions found at the Site, compliance with all ARARs through containment, collection, treatment, or other technologies will be extremely uncertain and costly. As a result, a waiver of certain chemical-specific ARARs will be provided as compliance with such requirements is technically impracticable from an engineering perspective. The estimated net present value cost for implementing the FB-2 remedy is $2,248,453.

Alluvial Groundwater - The remedial action selected to address contamination in the alluvial groundwater (this action was designated in the Proposed Plan as Alternative AL-4) consists of the following four (4) components: ICs, wellhead treatment, long-term groundwater monitoring, and the injection of enhanced biodegradation (EBD) agents into the alluvial groundwater.

The EPA anticipates that the ICs will be implemented to reduce the potential for exposure to the contaminated alluvial groundwater. The primary IC is expected to be proprietary in nature, i.e., a restrictive covenant and grant of access. Other ICs that might be used include the designation of the area of groundwater contamination as a "special use" area by MDNR's Division of Environmental Quality, the use of ordinances, inspection regimes, property notices, and/or public information. The ICs are discussed in greater detail below.

Wellhead treatment systems, such as activated carbon or air strippers, to remove COCs from groundwater to be used for a drinking water supply will be provided. The systems could be installed and maintained for any existing potable (drinking) water supply well in the event that it becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could reasonably be expected to have COCs could also have wellhead treatment systems installed. Monitoring of groundwater will be performed. This will be accomplished by obtaining groundwater samples from existing and new alluvial wells. The groundwater samples will be analyzed in the laboratory for COCs. Annual maintenance and repair of the monitoring wells will be necessary. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the RAOs were met or a determination was made that monitoring was no longer necessary.

Agents to accelerate natural biological processes that degrade or breakdown COCs will be injected into the alluvial groundwater. Installation of injection wells will be required. Periodic handling of the EBD agent will also be required.

Remedial action AL-4 meets both threshold criteria: it provides for the overall protection of human health and the environment, and complies with ARARs. This remedial action also provides for long-term effectiveness in the alluvial groundwater. The toxicity, mobility, and volume of the COCs in the alluvium will be reduced by the application of this action. Minimal short-term risks associated with injection well installation and EBD injection are possible. Implementation of this remedial action should present no problems. The estimated net present value cost for implementing the AL-4 remedy is $4,815,568.

Contingent Remedy - The EPA expects that through additional groundwater sampling conducted prior to the implementation of a remedial action for the contaminated alluvial groundwater, it can be demonstrated that conditions exist that support the use of Monitored Natural Attenuation (MNA) to achieve RAOs for this groundwater unit. If and when that demonstration has been made to EPA and the state's satisfaction, the remedy for this groundwater unit will become that described as AL-5 in the Proposed Plan. There is very little difference between the AL-4 and AL-5 remedies. Both rely on degradation of the COCs in the alluvial groundwater to achieve RAOs. The primary difference between AL-4 and AL-5 is that AL-4 requires the injection of an agent into the groundwater to accomplish the degradation of COCs while AL-5 does not. The achievement of RAOs for AL-5 relies on naturally occurring processes and chemicals found in the alluvial groundwater.

Quarterly groundwater monitoring of the alluvial aquifer is currently being conducted. During June 2005, the analyses performed on alluvial groundwater samples were expanded to include parameters that are used to determine whether or not degradation of chemicals is naturally occurring. It is anticipated that these parameters will continue to be evaluated for at least one year. Evaluation of the data will be performed to determine whether or not the alluvial groundwater can support natural attenuation. If that determination is made, injection of compounds into the groundwater will not be required to attain RAOs. The estimated net present value cost for implementing the AL-5 remedy is $3,905,536.

1.5 Statutory Determination

The selected remedies are consistent with CERCLA, and to the extent practicable, the NCP. The selected remedies are protective of human health and the environment, comply with federal and state requirements that are applicable or relevant and appropriate (except as waived), and are cost effective. The fractured bedrock remedy does not meet the regulatory preference for treatment since it is technically impracticable from an engineering perspective to treat groundwater in the bedrock. A TI waiver for the fractured bedrock groundwater is part of the ROD for OU 2. The specifics of the TI waiver are discussed in Sections 9.1.2 of the Decision Summary. The alluvium groundwater remedy does meet the regulatory preference for treatment; however, the contaminant source impacting the alluvium is the bedrock groundwater.

Because these remedies will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unrestricted use and unrestricted exposure, a statutory review will be conducted within five years after the initiation of the remedial action or by September 24, 2009, (five years after the initial five-year review) to ensure that the remedies are, or will be, protective of human health and the environment.

1.6 ROD Data Certification Checklist

The following information is in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this Site.

- COCs and their respective concentrations - Page 24
- Baseline risk represented by the COCs - Pages 21-22
- Cleanup levels established for COCs and the bases for these levels - Pages 26-27
- How source materials constituting principal threats are addressed - Page 44
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD - Page 16
- Estimated capital, annual operation and maintenance (O&M), total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected - Pages 40 & 43

1.7 Authorizing Signature

Cecilia Tapia
Cecilia Tapia, Director
Superfund Division

3/28/05
Date

PART II THE DECISION SUMMARY

1.0 Site Name, Location and Description

Cape Girardeau, Missouri, is a community of about 37,000 permanent residents located in southeastern Missouri along the Mississippi River. It is a regional hub for education, commerce, and medical care. Southeast Missouri State University is located in Cape Girardeau. It is estimated that approximately 50,000 additional people visit Cape Girardeau daily to work, go to school, get medical care, or shop. (The Site location is generally depicted in Figure 1 and more specifically depicted in Figure 2.)

The Site is comprised of approximately 6.4 acres located at 824 South Kingshighway (Highway 61) in Cape Girardeau, Missouri. The Site includes the former Missouri Electric Works (MEW) Site proper, as well as all areas which have become contaminated with: 1,1,1-TCA; TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and PCBs from the operations of MEW. The area impacted by contamination from the Site is shown in Figure 3. The Site is comprised, for the purposes of this ROD, into the Missouri Electric Works, Inc. (MEW, Inc.) property located along Kingshighway (the upland area) and the downgradient wetland area where contamination from the MEW, Inc. property has come to be located. These areas are depicted in Figure 4. The Site is located in a predominately commercial/industrial area of Cape Girardeau. The area surrounding the Site has experienced significant development since the early 1990s when the Site was listed on the National Priorities List (NPL).

The Site is located approximately 1.6 miles west of the Mississippi River. It is located in the hills adjacent to the west valley wall of the Mississippi River floodplain. Runoff leaves the Site through intermittent channels exiting from the north, south, and east boundaries (as shown in Figure 5) and eventually drains into the Cape La Croix Creek which is located 0.7 miles east of the Site. The Cape La Croix Creek flows 1.1 miles to the southeast and then enters the Mississippi River. The Site is bounded on the north by retail and warehouse properties, on the south by commercial storage, and on the east by a warehouse. A wetland is located approximately 700 feet south of the Site. The wetland area is underlain by alluvial deposits. The approximate location of the wetland with respect to the Site is indicated in Figure 6.

2.0 Site History and Enforcement Activities

2.1 Site History

MEW, Inc. acquired the Site in 1952. Prior to that, it is believed that the land was used for agricultural purposes. MEW, Inc. operated an electrical repair, service, and resale business at the Site from 1954 until 1992. No commercial activities have been conducted at the Site since 1992. MEW, Inc. continues to own the Site property located at 824 South Kingshighway.

The current land use for the surrounding area is predominately commercial. There are recreational soccer fields east of the Site. Significant new business construction has occurred near the Site. Land use in the area is not expected to change significantly. Cleanup requirements established by EPA took into consideration the theoretical possibility of residential use.

2.2 Contamination History

The MEW, Inc. serviced, repaired, reconditioned, and salvaged electrical equipment while it operated at the Site. Electrical equipment handled during this time consisted of oil-filled electrical transformers, electric motors, electric equipment controls, and oil-filled switches.

PCBs were first manufactured in the 1920s. Due to the fire-retardant properties of PCBs, they were often added to the dielectric fluid in electrical equipment to minimize the potential for fires. The Toxic Substances Control Act (TSCA) of 1978 banned the manufacture of PCBs and required that electrical equipment containing more than 500 parts per million (ppm) PCBs be removed from service. This requirement resulted from studies which indicated that PCBs are a probable human carcinogen, are extremely stable in the environment (they do not readily degrade), and bio-accumulate in the food chain. PCBs can be destroyed by subjecting them to high temperatures such as those generated in an incinerator. However, if the temperatures are not hot enough or if heat is applied for an insufficient amount of time, products of incomplete combustion (PICs) can be formed. The PICs for PCBs are dioxins and furans.

During its operational history, MEW, Inc. reportedly recycled materials from old transformers, selling copper wire, and reusing dielectric fluids. The salvaged transformer oil was generally filtered through Fuller's Earth for reuse. An estimated 90 percent of the transformer oil was recycled in this manner. According to business records obtained from MEW, Inc., more than 16,000 transformers were repaired or scrapped at the Site during its time of operation. The total amount of transformer oil that was not recycled was estimated to be approximately 28,000 gallons. Information gathered during interviews of former employees indicates that the majority of the non-recycled oil was disposed of on Site soils. In 1984, approximately 5,000 gallons of waste oil was removed by a contractor after a TSCA inspection by the MDNR.

Industrial solvents were used to clean the electrical equipment being repaired or serviced by MEW, Inc. Solvents were reused until they were no longer effective. Spills and the disposal of spent solvents onto Site soils were described by former employees during EPA-conducted interviews.

Site soils and adjacent properties were found to be contaminated with PCBs. Groundwater contamination was also detected. Contaminants included: 1,1,1-TCA;TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and PCBs.

2.3 Investigation History

Site contamination was first discovered in 1984 during a MDNR-conducted TSCA inspection. During this inspection, PCB-contaminated soils and inappropriate storage of over 100 55-gallon drums of PCB-contaminated oil were discovered. From 1985 through 1988, EPA conducted additional investigations to characterize the extent of Site contamination. These investigations indicated that PCB contamination in the surface soils was extensive (with PCB concentrations up to 58,000 ppm), that shallow subsurface soils at the Site were contaminated to a lesser extent, that offsite migration of PCB-contaminated soils had occurred along drainage paths, that measurable levels of PCBs were present on the Site buildings and on nearby offsite building walls, and that measurable concentrations of airborne PCBs were present.

The MEW Steering Committee (MEWSC), a group of former customers of MEW, Inc. identified by EPA as potentially responsible parties (PRPs), conducted a Remedial Investigation (RI) pursuant to an Administrative Order on Consent (Docket Number 7-89F-0002). This RI focused on soil and sediment contamination with minimal investigation of potential groundwater contamination. This RI was conducted between 1989 and 1990. The findings of this investigation are summarized as follows:

- PCBs adsorbed onto the near-surface soils had migrated to surrounding properties primarily via storm water runoff. The PCB concentrations decreased along the drainage features with greater distance from the Site.
- PCB contamination of soils with concentrations greater than 10 ppm was estimated to be 6.8 acres.
- PCB contamination was found at depth in the transformer storage and debris burial areas. The relative locations of these areas are indicated in Figure 7.
- VOC contamination was detected in soils at depths of 2.5 feet south and east of the MEW building, within the transformer storage area, and the debris burial area.
- PCBs were detected in Monitoring Wells #3 and #5. However, these detections were judged to be artifacts of well installation.
- VOCs, particularly 1,1-DCA, trans-1,2-DCE, chlorobenzene, and TCE were detected in the monitoring wells.

A ROD was issued by EPA in September 1990 which selected remedial actions to address contamination detected at the Site. The ROD identified onsite incineration of all soils having PCB contamination at levels greater than 10 ppm and the extraction and treatment of groundwater contaminated with chlorobenzene at concentrations greater than 20 parts per billion (ppb). For the purposes of the soils response, the ROD defined the Site as all areas that had become contaminated with PCBs originating from activities conducted by MEW, Inc. The ROD provided that all soils contaminated with PCBs at concentrations greater than 10 ppm to a depth of four feet and 100 ppm below four feet were to be excavated and incinerated. The ROD estimated that 20,000 to 30,000 tons of PCB-contaminated soils would require incineration.

After receipt of Special Notice Letters from EPA which informed them of their potential liability and invited them to negotiate a Consent Decree for Site cleanup with EPA, in January 1991 the MEWSC requested that they be allowed to further investigate groundwater contamination. The request was made because of the MEWSC's belief that a confining layer existed beneath the Site which would inhibit downward migration of chlorobenzene. Permission to conduct this post-ROD investigation was granted by EPA. During this investigation, which involved the drilling of groundwater monitoring wells, solution cavities within the bedrock were encountered at depths of 110 feet, 215 feet, and 320 feet below ground surface (bgs). The subsurface information obtained during the drilling and installation of MW-11A is presented as Figure 8.

These solution features were mud-filled. The mud was contaminated with PCBs. PCB contamination was also detected in the groundwater. The well-hole for MW-11A was advanced to a depth of 405 feet; analysis of groundwater from this depth indicated PCB contamination at a concentration of 2 ppb. Two separate OUs, one for soil and one for groundwater, were designated after receipt of the 1991 groundwater information. As a result of this new information, work to remediate groundwater at the Site was postponed until a focused groundwater investigation could be completed.

In accordance with the terms of the Consent Decree filed with the U.S. District Court, Eastern District of Missouri, Southeastern Division under Civil Action Nos. 1:92CV00078GFG and 1:92CV00088GFG (federal and state actions joined), groundwater investigation activities began after soil remediation activities were complete. Although the Consent Decree was lodged in the Federal District Court in June 1992, it was not finally approved by the Court until March 1998 and did not become effective until that date. The groundwater investigation required by the Consent Decree began during 2000 and was completed during the summer of 2005. The groundwater monitoring system at the Site in 2000 is identified in Figure 9. The work was performed by KOMEX H2O on behalf of the settling defendants to the Consent Decree, who performed the work as the MEW Site Trust Donors (MEWSTD).

The groundwater investigation included the following:

- Field reconnaissance and field mapping of bedrock
- Fractured rock lineament study
- Installation of a tipping bucket rain gauge with a built-in data logger at the location of MW-6A
- Quarterly download and analyses of precipitation measurements
- Quarterly groundwater monitoring and sampling
- Quarterly download and analyses of water level measurements
- Sediment sampling from groundwater wells
- Laboratory analyses of groundwater and sediment samples
- Installation of groundwater data loggers in groundwater monitoring wells MW-3, MW-11, MW-11A, MW-16A, and MW-16C
- Bedrock fracture modeling
- Geophysical electrical resistivity tomography, seismic reflection, and refraction assessment of the southeastern portion of the Site in the vicinity of wells MW-3, MW-5, MW-11, and MW-11A
- Geoprobe investigation to assess and refine geophysical interpretation
- Installation of sixteen (16) new groundwater monitoring wells
- Installation of twenty-three (23) boreholes to assist in the location of the new monitoring wells
- Sampling and analyses of drill cuttings
- Installation of one piezometer (MW-E1) in the drainage-way southeast of the upland area
- Installation of two surface water level stilling wells in the Wetland Creek and Retention Pond

- Development of conceptual models of groundwater flow (fractured bedrock and alluvial)
- Submission of quarterly groundwater monitoring reports, including summaries of investigation activities during the quarter

Quarterly groundwater monitoring is ongoing. The investigation indicates that the groundwater within the fractured bedrock is contaminated with: 1,1,1-TCA; TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and non-filtered PCBs. Sediment particles moving within the bedrock fractures may have PCBs attached. TCE has been detected above the maximum contaminant level[1] (MCL) in the groundwater in the wetland area.

2.4 Enforcement History

At the time that EPA's Superfund Division became involved with the Site in 1986, MEW, Inc. was still operating at the Site. The business owner was using portions of the Site to grow fruit and vegetables. The EPA issued an Administrative Order requiring the owner/operator of the Site to stop handling oil-filled electrical equipment with PCB concentrations greater than 2 ppm at the Site, to place erosion barriers in all drainage features to minimize the amount of PCB contamination migrating offsite via storm water runoff, and to stop selling and giving away vegetables grown on the Site.

Pursuant to the authority of section 104(e) of CERCLA, EPA requested from MEW, Inc. copies of its business records. These records were provided to EPA. As a result, approximately 700 former customers of MEW, Inc. were contacted by EPA and notified of their potential liability. A group of 70 former customers formed the MEWSC during 1987. As discussed above, the MEWSC conducted the initial RI/feasibility study (FS) at the Site.

The Site was proposed for inclusion on the NPL[2] of Superfund sites during 1989. The Site was included on the NPL during February 1990. Notification of the listing of the MEW site was published in the Federal Register on February 21, 1990, 55 Fed. Reg. 6154.

In December 1990, Special Notice Letters were issued by EPA to 323 former customers of MEW, Inc. who had sent oil-filled electrical equipment to the Site. A group of 175 former customers entered into Consent Decree negotiations with the United States and the state which required implementation of the work described in the 1990 ROD. The Consent Decree was signed by the 175 former customers of MEW, Inc., MDNR, and by the United States. The Consent Decree was lodged with the United States District Court in June 1992. The Consent Decree was initially approved and entered by the Court in August 1994. Subsequent to that approval, however, a group of former customers of MEW, Inc. appealed the entry of the Consent Decree to the U.S. Eighth Circuit Court of Appeals. In August 1995, the Eighth Circuit remanded (sent back) the Consent Decree to the District Court for further consideration. The

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[1] MCL is defined in the Safe Drinking Water Act, 42 U.S.C. § 300f, as the maximum permissible level of a contaminant in water which is delivered to any users of a public water system.

[2] The NPL is a list compiled by EPA pursuant to section 105 of CERCLA, of uncontrolled hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response.

Consent Decree was approved and entered a second time by the District Court in August 1996. This approval and entry was also appealed. In December 1997, the Eighth Circuit reaffirmed (agreed with) the District Court's approval of the Consent Decree, and the Consent Decree became effective in March 1998.

The Settling Defendants to the Consent Decree submitted a focused FS which presented alternatives for soil remediation to EPA in the fall of 1994. At that time, the Settling Defendants requested that EPA consider including thermal desorption as an approved soil treatment technology. The EPA agreed and in February 1995 issued an Explanation of Significant Differences (ESD) to the ROD which included thermal desorption as an acceptable remedial technology for use in remediating Site soils. The public was given an opportunity to review and comment on the ESD.

2.5 Cleanup History

The remedial action for the soils (OU 1) began with Site preparation activities during 1999. A pre-construction meeting was held on June 24, 1999. Williams Environmental Services (WES) was selected by the Settling Defendants as the soil remedial action contractor. WES used a two-phase thermal desorption unit (unit) to treat the PCB-contaminated soils. As required in the Consent Decree, a performance test of the unit was conducted on October 19, 1999. The purpose of the performance test was to ensure that the unit could destroy the PCBs without the formation of PICs. The PICs that may be created during the thermal treatment of PCBs include dioxins and furans. Soils treated during the performance test were analyzed for PCBs, dioxins, furans, chromium, and lead. Dioxins and furans at concentrations greater than 1 ppb 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) equivalents (TEQ) were detected in the treated soil after the first performance test. As a result, the unit was shut down by EPA to evaluate what had caused the problem and how it could be addressed. The unit was cleaned and the operating parameters changed. A second performance test was conducted in December 1999. The initial run for this test did not meet isokinetic requirements, and the last run did not meet destruction removal efficiency requirements, and the test was declared invalid because at least three runs need to meet all requirements. A third performance test was conducted in April 2000. This test met all requirements. WES was then authorized by EPA to begin processing contaminated soil.

Soils with PCB concentrations in excess of 10 ppm were excavated and stockpiled onsite. These soils were processed (screened) to ensure that the maximum particle size was less than two (2) inches. After screening, the soils were again stockpiled or fed to the pug-mill for treatment in the thermal unit. Treated soils were discharged from the unit and stored in 600-ton piles. These piles were sampled and analyzed for PCBs. Treated soils with PCB concentrations of less than 2 ppm were approved for use as backfill. The 1990 ROD identified 2 ppm PCBs as acceptable for use as backfill.

Deeper than anticipated PCB contamination was encountered near the location of the thermal desorption unit. During excavation discolored soil was detected traversing the area. The discolored soil was grayish in color, and field analytical data indicated high PCB concentrations. Continued excavation indicated that the deep contamination was confined to a "trench-like" feature. The location of this feature is presented as Figure 10. Conventional excavation was stopped at a depth of 19 feet bgs. The PCB concentration at this depth was over 500 ppm. Engineering and safety considerations required that the hole be backfilled until it could be determined how to proceed. An investigation of the soils' excavation overlying bedrock, using a Geoprobe, was performed. Geoprobe samples were obtained to the depth of bedrock or 45 feet bgs. The PCB contamination was detected at that depth. A retaining wall was constructed to protect the thermal unit during excavation of the deep contamination. All soils with PCB concentrations exceeding 10 ppm at any depth were excavated and thermally treated onsite.

Buried debris was encountered in the trench-like feature near the east perimeter of the Site. The majority of the debris was large. The debris was considered to be PCB contaminated and disposed of in an offsite Resource Conservation and Recovery Act (RCRA) permitted hazardous waste landfill.

Water that had been in contact with PCB-contaminated soils or debris was processed through the onsite water treatment plant. This included both storm water and any water used or generated during the treatment process. Treated water was used to re-hydrate treated soils and for dust control. Excess treated water was discharged to the city of Cape Girardeau's Publicly Owned Treatment Works (POTW). The treated water attained the specifications identified in the agreement between WES and the city of Cape Girardeau, Missouri.

Onsite thermal desorption of the PCB-contaminated soils began in April 2000 and concluded on July 25, 2000. Thirty-eight thousand, three-hundred seven (38,307) tons of PCB-contaminated soils were excavated and treated. Two thousand, six-hundred forty-four (2,644) tons of debris were excavated and sent to a RCRA hazardous waste landfill.

About half of the former customers, identified as being potentially responsible for the contamination at the Site, have been of MEW, Inc. involved in investigation or cleanup activities. A cost recovery action has been filed by the United States against some of the liable parties who have not participated in the remedial efforts at the Site.

3.0 Community Participation

Representatives of EPA and MDNR met with adjacent property owners and other interested parties during July 1989. The purpose of these meetings was to discuss the conditions at the Site and health risks posed by the Site to the general public. The EPA staff participated in two local Cape Girardeau radio "talk" shows during July 1989. During these programs, listeners were able to call in and ask questions of EPA staff concerning MEW activities.

A document repository was established at the Cape Girardeau Public Library. The Administrative Record for the MEW Site was placed in the repository during August 1989. An addendum to the Administrative Record was placed in the library during August 1990.

Public meetings were held in September 1989 and June 1990 to inform the citizens about the soils RI and its findings. The Proposed Plan and RI/FS reports for OU 1 were released to the public on August 18, 1990. Notice of the public comment period for the Proposed Plan was published in local newspapers on August 19, 1990. A public hearing was held on August 30,

1990. An availability session was held during December 1994 to get public input concerning the use of thermal desorption as a treatment technology. Several availability sessions were held during the soil remedial action. Fact sheets have been issued for all significant Site events.

A public meeting was held on September 8, 2005, to inform the citizens about the groundwater RI, its findings, and the preferred remedial alternatives to address groundwater contamination. The Proposed Plan and RI/FS reports for OU 2 were released to the public on August 21, 2005. Notice of the public comment period for the Proposed Plan was published in local newspapers on August 21, 2005. The public comment period ended on September 19, 2005. No public comments were submitted during this period.

4.0 Scope and Role of Operable Unit

Three (3) OUs have been designated at the Site. Remediation of the PCB-impacted soils was the focus of OU 1. OU 2 will address groundwater contamination. Ecological risk to the wetland area, from soils that migrated from the Site to the wetland area through surface water runoff, will be the focus of OU 3.

The original strategy for addressing contamination at the Site included thermal treatment of the impacted soils and the extraction and treatment of groundwater contaminated with chlorobenzene. These actions were selected to reduce the threat to human health and the environment represented by contamination at the Site. When it was discovered in 1991 that deep groundwater contamination was present at the Site, a decision was made to perform the remedial action selected for the soil and perform additional investigation of the groundwater contamination. These decisions were incorporated in the Statement of Work for the Consent Decree.

The soil remedial action was completed in 2000. The excavation and treatment of the PCB-contaminated soils with concentrations greater than 10 ppm resulted in a source control removal for the groundwater contamination.

Groundwater studies began in 2000 at the conclusion of the soil remedial action. Groundwater investigation efforts were not performed before the soil remedial action due to the potential for damage to expensive groundwater monitoring wells. Additionally, it is known that there is no current groundwater use in the vicinity of the Site.

The actions proposed to address groundwater contamination at OU 2 (groundwater OU) focus on the most efficient ways to deal with the contamination in the bedrock and in the alluvium while still protecting human health and the environment. The actions proposed in this document will address groundwater contamination and will provide what EPA believes to be the best balance when considering the nine (9) criteria specified in section 300.430(e)(9)(iii) of the NCP.

Groundwater monitoring of COCs will be conducted as part of this remedial action. The data generated during long-term monitoring will be used to assess ecological risks to the wetland area. With the implementation of the groundwater cleanup, risks to human health and the environment will be within acceptable ranges. Investigation of the contamination present in, and evaluation of the ecological risks to, the wetland area will be performed As part of OU 3. Actions necessary to protect the environment (the wetland area) will be identified after the study and evaluation are complete.

5.0 Site Characteristics

The upland area is located on top of a flattened ridge that is oriented southwest to northeast. This ridge separates the valley of the Cape LaCroix Creek to the north and a low-lying wetland area to the south. Wetland Creek flows eastward across the wetland area and joins Cape LaCroix Creek approximately 0.7 miles east of the upland area. Cape LaCroix Creek joins the Mississippi River about 1.5 miles southeast of the upland area. Figure 11 provides topographical relief of the area with major features identified.

Ground surface elevation at the upland area is approximately 405 feet above sea level (ASL). South of the upland area, the ground slopes downward toward Wilson Road. Wilson Road forms the northwestern boundary of the wetland area. A runoff channel is located near the eastern boundary of the MEW, Inc. property and drains toward the wetland area to the southeast. Elevation of the wetland area ranges from 360 feet ASL at Wilson Road to 351 feet ASL at the Wetland Creek. North of the MEW, Inc. property, the ground surface slopes downward to the relatively flat valley bottom of Cape LaCroix Creek.

The MEW, Inc. property is bounded on the north and east by retail and commercial properties and to the south by retail properties. The western boundary of the MEW, Inc. property is U.S. Highway 61 (Kingshighway). The upland area currently consists of a grass field with a single concrete building in the northwest corner. The building is used for equipment storage.

Southeastern Missouri contains exposures of geologic formations ranging in age from Paleozoic to recent. Older Paleozoic exposures are typically confined to the Ozark Plateau region. Geologic structure of bedrock in southeastern Missouri generally consists of unfolded shallow dipping beds except in areas where faulting has occurred. Faulting within the state is most prevalent in the pre-Pennsylvanian period. Geological faults common to Missouri average a displacement distance of 100 feet.

The uppermost deposit in the Cape Girardeau area consists of an undifferentiated surficial Pleistocene age loess. The loess can be up to 30 feet thick and consists of silts and silty clays. The loess was deposited during an eolian (wind blown) erosional and depositional period within the Pleistocene age. The loess overlies limestone bedrock of the Ordovician age.

The Ordovician age limestone bedrock dips toward the northeast at a maximum of two degrees. The bedrock units contain numerous faults that are not seismically active. However, the Cape Girardeau area is about 25 miles from the epicenter line of the New Madrid area earthquakes. The Cape Girardeau fault is located one mile east-northeast of the Site.

Beneath the loess covering the Site lays the Plattin Formation. The Plattin Formation is a slightly dolomitic and fossiliferous limestone which can be over 400 feet thick. The Plattin Formation is underlain by the Rock Levee Formation.

The United States Geological Survey (USGS) solid geology map indicates two faults trending northwest to southeast near the western boundary of the upland area. A rock unit labeled "Megabreccia" is mapped between these two faults and is likely to consist of tectonically disrupted limestones associated with the fault zone. Breccia materials were not encountered during Site investigations.

At the upland area, the native surficial soils consist of 15 to 25 feet of the loess underlain by a brownish-red gravelly clay. The loess erodes easily. The gravelly clay is derived by the weathering degradation of the Plattin Formation. The Plattin Formation was encountered at depths ranging from 30 to 90 feet bgs, often within just a short lateral distance. The great variability of the depth to bedrock is very likely related to the development of a karstic limestone surface. Karstic surfaces, as shown in Figure 12, are typified by differential or uneven weathering of bedrock, particularly limestone, surfaces. This uneven weathering is generally caused by water flowing over or through bedrock along bedding planes, fractures, and joints.

The majority of the MEW, Inc. property was excavated to remediate the PCB-contaminated soils. These soils were thermally treated and later used to backfill excavations. The treated soils are dark in color and erode easily.

Subsurface information obtained during the groundwater RI was derived from the installation of 16 new monitoring wells and the construction of 23 boreholes. Locations of the monitoring wells are indicated in Figure 13.

Interpretation of the bedrock in the upland area, using data gathered during subsurface investigations, geophysical investigations, and fracture alignment studies indicates the presence of several significant fractures/fracture zones. The locations of these features are shown in Figure 14. The interpretations can be summarized as:

- The upper weathered zone or epikarst is located within the upper 50 feet of the bedrock. This zone is characterized by large linear solution channels with large solution features occurring at the intersections of vertical fractures.
- The intermediate bedrock, 50 to 164 feet deep, is characterized by persistent vertical fractures with limited solution features.
- The deep bedrock, greater than 164 feet deep, has discrete vertical fractures. Discrete solution features have been detected at depth.

Groundwater level hydrographs from well MW-3 (completed in the weathered zone) and well MW-11 (completed in the intermediate zone) indicate that groundwater within the upper 165 feet of limestone has good hydraulic communication. The hydrograph for well MW-11A (completed in the deep zone) indicates a different response to precipitation events than those for wells MW-3 and MW-11. This suggests the hydraulic connectivity/conductivity between the intermediate and deep limestone is not as great as that between the upper and intermediate zones. There appears to be a downward hydraulic gradient between the upper and deep bedrock. Hydrographs for the upper, intermediate, and deep bedrock are provided as Figure 15.

The abundant fractures and solution features within the limestone result in myriad possible groundwater flow paths. Conceptual groundwater flow within limestone is depicted in Figure 16. Identification of contaminant migration within the bedrock is impossible to predict. Pumping water from karst environments often worsens the problem by inducing contaminant migration in other directions. Contaminated groundwater originating from the upland area could, and probably does, exit the bedrock into the alluvium in numerous places.

Information on the subsurface geology at the Site gathered during the investigations indicates the presence of a deep erosional feature or depression in the vicinity of the wetland area. The materials encountered at borehole locations within the wetland area indicate alluvial deposits within this feature. The alluvial deposits consist of rounded sands, silty sands, and occasional discontinuous clay layers. Rounded coal deposits, which provide additional evidence of deposition from flowing water, were encountered at MW-21B. Interpretations of borehole information indicate that a significant portion of the Plattin Formation has been eroded south of Wilson Road. The depression extends to a depth of 140 feet bgs at the locations of MW-16C and MW-20C. The feature is likely a buried river channel. Several interpretations can be made regarding the deep area within the channel; the deep area could be the result of differential erosion within the channel or collapse of a karstic structure (sinkhole).

Cross-sections of the study area have been prepared to assist in highlighting the geological subsurface from the upland area to the wetland area. Three cross-sections, identified as A-A', B-B', and C-C' have been developed to assist in the understanding of the subsurface lithology and the significant differences that exist between the upland and wetland areas. The locations of these cross-sections are indicated in Figure 17. Cross-section A-A', Figure 18, extends from well MW-9 on the upland area to well MW-21B in the southern portion of the wetland area. Cross-section B-B', Figure 19, extends from MW-18 to BH-19I. Cross-section C-C', Figure 20, extends from MW-20C to BH-19F. The upland area is characterized by loess overlying limestone bedrock. The wetland or valley area is characterized by alluvial deposits.

The presence of the discontinuity within the bedrock, the alluvium-filled depression, indicates that there are two distinct groundwater regimes in the vicinity of the Site. Figure 21 presents an interpretation of the upland/wetland area interface and possible groundwater flow in both the bedrock and alluvium. Movement of groundwater within the bedrock is controlled by fracture and bedding planes, both vertical and horizontal. It appears that the majority of the bedrock groundwater flow is occurring in the upper and intermediate bedrock zones. Groundwater movement within the depression can be characterized as porous-media flow. Groundwater originating in the bedrock flows into the alluvium. Data gathered during the groundwater RI indicate that there is an upward hydraulic gradient in the area near well clusters MW-16, MW-20, and MW-21. Discussions concerning groundwater will be identified as pertaining either to the fractured bedrock groundwater or the alluvial groundwater. This distinction is necessary due to the fundamental differences in the contaminant transport and groundwater flow within the two groundwater regimes.

Quarterly groundwater monitoring was conducted from 2001 until February 2005. Groundwater samples were analyzed for inorganic compounds; VOCs, SVOCs, and PCBs were performed on collected groundwater samples. The monitoring well network initially consisted of wells installed in the upland area. Monitoring wells were installed in the wetland area during 2003 and 2004. Groundwater samples from the wetland area (alluvium) were not analyzed for PCBs. A summary of the groundwater data collected between 2000 and 2005 is attached as Appendix A. The main organic compounds detected include: 1,1,1-TCA; TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and PCBs. Summaries for each compound are included as Tables A-1 to A-14. Groundwater data collected between 1989 and 1991 are attached as Tables A-15.

Chlorobenzene, 1,2-DCB, 1,3-DCB, 1,4-DCB, 1,2,4-TCB, and benzene are all potential components of dielectric fluid contained in the transformers handled by MEW, Inc. Degradation of chlorinated solvent compounds can occur through both abiotic and biotic mechanisms. Chlorinated solvents may biodegrade both aerobically and anaerobically. Degradation products and pathways for 1,1,1-TCA, PCE, and chlorobenzene are provided as Figures 22-24.

The source of organic contamination impacting the groundwater is thought to be the result of the business practices of MEW, Inc. The MEW, Inc. property soils were significantly impacted as a result of the operations of MEW, Inc. The soil remedial action removed and treated over 38,000 tons of PCB-contaminated soils. During the soil remedial action, PCB contamination was detected to the top of the bedrock. The source areas for the groundwater contamination are thought to be contamination remaining in the soils in the area of wells MW-3, MW-5, MW-11, and MW-11A (Source Area 1), and the former transformer storage area (Source Area 2). These source areas are indicated in Figure 25. All PCB contamination in the area of wells MW-3, MW-5, MW-11, and MW-11A could not be removed without damage to the wells. Therefore, some PCB contamination may remain in that area. For that reason, it is assumed that Source Area 1 is the source for chlorobenzene, benzene, 1,3-DCB, and 1,4-DCB contamination. Source Area 2 is the considered to be the source of TCE and PCE since there are indications that solvents containing TCE and PCE may have been disposed of in this area. TCE and PCE do not have the affinity for soils that PCBs do and, therefore, may have migrated deeper.

6.0 Current and Potential Future Site and Resource Uses

Current and anticipated future land and groundwater uses are an important component of risk evaluation. The upland area of the Site is zoned as "M2" indicating that heavy industrialized uses are permitted; the wetland area of the Site is zoned as "M1" indicating that light industrial uses are permitted. Neither area is currently zoned for residential uses; however, a special use permit or zoning variance could be granted that would allow future residential land use. No populations are currently exposed to the contaminated groundwater. The decision tree process used to determine which exposure pathways were evaluated is presented as Figure 26. The Baseline Human Health Risk Assessment (BHHRA) considered four populations that could have future exposure to the contaminated groundwater. These populations include: 1) onsite adult worker, 2) offsite construction worker, 3) offsite child resident (between the ages of 0 to 6 years), and 4) offsite adult resident. The onsite worker and the offsite construction worker scenarios were considered as possible current exposures as well as future exposures. (For purposes of this discussion, "onsite" refers to the MEW, Inc. property and "offsite" refers to the wetland area.)

7.0 Summary of Site Risks

A BHHRA was conducted by the Settling Defendants to assess the risks posed to human health by the groundwater contaminants. An ecological risk assessment was not performed. Nineteen (19) groundwater monitoring events were conducted during the groundwater RI. Inorganic compounds were investigated during the initial RI work, and it was determined that the inorganic compound concentrations detected at the Site were not associated with the activities of MEW, Inc. Therefore, inorganic compounds were not evaluated during the BHHRA. Organic chemicals of potential concern (COPCs) were selected from all compounds analyzed in groundwater samples from the Site. The COPCs were identified by comparing the maximum concentrations detected with screening toxicity values. For compounds that were not detected, the maximum method detection limit (MDL) was used as the screening concentration. The EPA, Region 9, Preliminary Remediation Goals (PRGs) were used as toxicity screening values when available. For non-carcinogenic compounds, a value of one-tenth the PRG was used to account for potential accrual of non-cancer health effects.

Chemical analysis was conducted for a total of 102 organic compounds. Twenty-nine (29) organic compounds were detected in Site groundwater samples; of these, seventeen (17) had maximum concentrations in excess of the screen toxicity value and were retained as COPCs. Thirty-one (31) of the undetected compounds had a maximum MDL in excess of the screening toxicity value. These compounds were also retained as COPCs. Eleven (11) of the non-detected COPCs had no available PRGs. Surrogate screening values were used for these compounds. An additional four (4) COPCs with no available screening toxicity values were retained as COPCs, but were not evaluated quantitatively in the risk assessment. A total of fifty-two (52) COPCs were retained and evaluated in the BHRRA. The COPCs are identified in the following table.

Chemicals of Potential Concern (COPCs)

Detected Organics	Undetected Organics	
1,1-Dichloroethane	1,1,2,2-Tetrachloroethane	Benzo(k)fluoranthene
1,2,4-Trichlorobenzene	1,1,2-Trichloroethane	Bis(2-Chloroisopropyl) Ether
1,2-Dichloroethene Total	1,2-Dichloroethane	Carbon Tetrachloride
1,3-Dichlorobenzene	1,2-Dichloropropane	Chlorodibromomethane
1,4-Dichlorobenzene	2,4,6-Trichlorophenol	Dibenzo(a,h)Anthracene
2-Chlorophenol	2,4-Dinitrotoluene	Dibenzofuran
Aroclor-1260	2,6-Dinitrotoluene	Hexachloro-1,3-Butadiene
Benzene	3,3-Dichlorobenzidine	Hexachlorobenzene
Bis(2-Chloroethyl) Ether	4,6-Dinitro-2-Methyl Phenol	Indeno(1,2,3-cd)Pyrene
Bis(2-ethylhexyl)phthalate	Aroclor 1016	2-Methylnaphthalene
Bromodichloromethane	Aroclor-1221	Nitrobenzene
Chlorobenzene	Aroclor-1232	Pentachlorophenol
Chloroform	Aroclor-1242	Vinyl Chloride
Naphthalene	Aroclor-1248	Bis (2-Chloroethoxy) Methane*
N-Nitrosodi-n-propylamine	Aroclor-1254	4-Bromophenyl Phenyl Ether*
Tetrachlorethene	Benzo(a)anthracene	4-Chlrophenyl Phenyl Ether*
Trichloroethene	Benzo(a)pyrene	4-Chloro-3-Methylphenol*
	Benzo(b)fluoranthene	

* Quantitative evaluation of the risks associated with these chemicals is not possible due to the absence of available data. These chemicals have not been included in the risk calculations.

Pathways through which populations could potentially become exposed were evaluated. These pathways include: 1) inhalation of the COPCs, 2) ingestion of the COPCs, and 3) dermal (skin) contact with the COPCs. Modeling of groundwater flow was performed for the fractured bedrock and the alluvium. Using the results of these groundwater models, four (4) exposure points were established. These exposure points are identified as Hypothetical Well A (HW-A), Hypothetical Well B (HW-B), Hypothetical Well C (HW-C), and Hypothetical Well D (HW-D). The locations of these exposure points are indicated on Figure 27.

- HW-A, identified as "Well A" on Figure 27, is located to the southeast of the MEW property near the now abandoned MW-8. HW-A is hydraulically down-gradient of the upland source areas. The well is situated within the modeled COPC plume. HW-A represents worst-case concentrations for the majority of the COPCs.
- HW-B, identified as "Well B" on Figure 27, is located hydraulically down-gradient of the upland area next to Wilson Road. It is situated near the center of the modeled COPC plume. HW-B contains worst-case concentrations for COPCs not present at the location of HW-A.
- HW-C, identified as "Well C" on Figure 27, is located east of exiting monitoring wells MW-17A and MW-17B. This well is located outside the boundary of the modeled COPC plume.
- HW-A and HW-B locations were selected as exposure points because these locations represent the worst-case conditions for contaminants migrating from the upland area.
- HW-D is not identified on Figure 27. The location of HW-D represents the maximum predicted or actual COPC concentrations modeled at HW-A and HW-B

or measured at monitoring wells. As such, the location of HW-D could not be predicted with the modeling tools utilized during this study. This scenario was included as a conservative measure.

Incremental lifetime cancer risks and a measure of the potential for non-carcinogenic adverse health effects were estimated for each population in each exposure scenario. The incremental lifetime cancer risk (ILCR) from a carcinogen is calculated as a product of the reasonable maximum daily intake (quantified as milligrams per kilogram of body weight per day, mg/kg-d) and the cancer slope factor (CSF). The resultant product is an estimate of the incremental cancer risk. The EPA groups chemicals according to their potential for carcinogenic effects based on clinical evidence.

- Group A — Human carcinogen
- Group B — Probable human carcinogen
- Group C — Possible human carcinogen
- Group D — Insufficient data to classify as a human carcinogen
- Group E — Not a human carcinogen

The following table provides information regarding the classification of each COPC.

Carcinogenic and Non-Carcinogenic COPC

Carcinogens			
Chemical	Classification	Chemical	Classification
Tetrachlorethene	C-B2 Continuum	Aroclor-1254	B2
Trichloroethene	C-B2 Continuum	Aroclor-1260	B2
1,1,2,2-Tetrachloroethane	C	Benzo(a)anthracene	B2
1,1,2-Trichloroethane	C	Benzo(a)pyrene	B2
1,1-Dichloroethane	C	Benzo(b)fluoranthene	B2
1,4-Dichlorobenzene	C	Benzo(k)fluoranthene	B2
Chlorodibromomethane	C	Bis(2-ethylhexyl)phthalate	B2
Hexachloro-1,3-Butadiene	C	Bis(2-Chloroethyl) Ether	B2
Naphthalene	C	Bromodichloromethane	B2
1,2-Dichloroethane	B2	Carbon Tetrachloride	B2
1,2-Dichloropropane	B2	Chloroform	B2
2,4,6-Trichlorophenol	B2	Dibenzo(a,h)Anthracene	B2
2,4-Dinitrotoluene	B2	Hexachlorobenzene	B2
2,6-Dinitrotoluene	B2	Indeno(1,2,3-cd)Pyrene	B2
3,3-Dichlorobenzidine	B2	Nitrosodi-n-propylamine	B2
Aroclor-1221	B2	Pentachlorophenol	B2
Aroclor-1232	B2	Benzene	A
Aroclor-1242	B2	Vinyl Chloride	A
Aroclor-1248	B2		

Note: A chemical with a B2 classification is a probable human carcinogen.

Non-Carcinogens

Chemical	Classification	Chemical	Classification
2-Chlorophenol	Not known	1,2-Dichloroethene (cis)	D
4,6-Dinitro-2-Methyl Phenol	Not known	1,2-Dichloroethene (trans)	D
Aroclor 1016	Not known	1,2,4-Trichlorobenzene	D
Bis(2-Chloroisopropyl) Ether	Not known	1,3-Dichlorbenzene	D
Methylnaphthalene	Not known	Chlorobenzene	D
Trichloroethene[1]	Highly likely	Dibenzofuran	D
		Nitrobenzene	D

1 Trichlorethene has not been conclusively identified as a carcinogen. However, EPA guidance indicates that it should be considered a possible to probable carcinogen. Therefore, the compound is listed in both tables.

For the non-carcinogenic effects of chemicals, EPA assumes a dose exists below which no adverse health effects are observed. Below this "threshold" exposure, it is believed that exposure to a chemical can be tolerated with no adverse health effects, and the body burden is not increased. The reference dose (RfD), expressed in units of mg/kg-d, is the threshold dose. An RfD is specific to the chemical, route of exposure, and duration over which the exposure occurs. A Hazard Index (HI) value was estimated for non-carcinogenic compounds. The HI is a ratio between the estimated exposure dose and the RfD. Generally, if the HI is less than one (1), the predicted exposure dose is unlikely to cause harmful non-carcinogenic health effects. The potential for adverse non-carcinogenic health effects increases as the HI increases above one.

Due to the potential additive effects of contaminant exposure via the different exposure pathways, ingestion, inhalation, and dermal contact scenarios which would result in contact with contaminated groundwater were identified. There are two routes of potential human exposure: 1) occupational, and 2) residential. Occupational exposure could occur to workers employed on the MEW, Inc. property or to construction workers in the wetland area. Residential exposures were considered for future dwellings constructed in the wetland area. These exposure assumptions were evaluated for future uses of the MEW, Inc. property and the wetland area. No current exposure risk was evaluated for the groundwater. Information indicates that there are currently no users of either the upper-intermediate or deep portions of the aquifer.

For purposes of the BHHRA, it was assumed that no remedial work would be performed at the Site. This was done so that possible future risks posed by the contamination could be evaluated. The calculated potential risks posed by the groundwater contamination are summarized in Tables 1 and 2.

The analyses performed indicated that groundwater impacted by Site contamination presents an unacceptable risk to human health. The calculated human health risks are the result of chemicals released to the environment during the operations of MEW, Inc. Response actions are necessary to address the unacceptable risk to human health posed by releases from the Site.

TABLE 1

SUMMARY OF TOTAL INCREMENTAL LIFETIME CANCER RISK (ILCR) FOR EACH EXPOSURE SCENARIO FOR RME AND CTE

			Reasonable Maximum Exposure (RME)			Central Tendency Exposure (CTE)		
Exposure Scenario	**EPA Acceptable Risk Range**	**Receptor**	**High (0.4)**	**Moderate (0.02)**	**Low (0.006)**	**High (0.4)**	**Moderate (0.02)**	**Low (0.006)**
ONSITE WORKER	1.E-04 to 1.E-06	Adult	1.E-05	6.E-06	6.E-06	2.E-06	1.E-06	1.E-06
OFFSITE CONSTRUCTION Worker	1.E-04 to 1.E-06	Adult	5.E-07	4.E-07	4.E-07	2.E-07	1.E-07	1.E-07
OFFSITE RESIDENT – WELL A	1.E-04 to 1.E-06	Child	**4.E-03**	**4.E-03**	**4.E-03**	**8.E-04**	**8.E-04**	**8.E-04**
		Adult	**8.E-03**	**7.E-03**	**7.E-03**	**2.E-03**	**2.E-03**	**2.E-03**
		Total	**1.E-02**	**1.E-02**	**1.E-02**	**3.E-03**	**3.E-03**	**3.E-03**
OFFSITE RESIDENT – WELL B	1.E-04 to 1.E-06	Child	**3.E-03**	**3.E-03**	**3.E-03**	**6.E-04**	**6.E-04**	**6.E-04**
		Adult	**6.E-03**	**5.E-03**	**5.E-03**	**1.E-03**	**1.E-03**	**1.E-03**
		Total	**9.E-03**	**8.E-03**	**8.E-03**	**2.E-03**	**2.E-03**	**2.E-03**
OFFSITE RESIDENT – WELL C	1.E-04 to 1.E-06	Child	8.E-07	3.E-07	3.E-07	2.E-07	6.E-08	6.E-08
		Adult	1.E-06	5.E-07	4.E-07	3.E-07	1.E-07	1.E-07
		Total	2.E-06	4.E-07	3.E-07	4.E-07	8.E-08	7.E-08
OFFSITE RESIDENT – WELL D (*WORST CASE SCENARIO*)	1.E-04 to 1.E-06	Child	**4.E-03**	**4.E-03**	**4.E-03**	**8.E-04**	**8.E-04**	**8.E-04**
		Adult	**8.E-03**	**7.E-03**	**7.E-03**	**2.E-03**	**2.E-03**	**2.E-03**
		Total	**1.E-02**	**1.E-02**	**1.E-02**	**3.E-03**	**2.E-03**	**2.E-03**
TRESPASSER	1.E-04 to 1.E-06		1.E-08	1.E-08	1.E-08	2.E-09	2.E-09	2.E-09
			2.E-08	2.E-08	2.E-08	3.E-09	3.E-09	3.E-09
			3.E-08	3.E-08	3.E-08	5.E-09	5.E-09	4.E-09

Notes: Bold values indicate Total ILCR exceeds acceptable level of risk (Greater than 1.0E-4).
* All values have been rounded to one significant digit.

TABLE 2

SUMMARY OF HAZARD INDEX (HI) FOR EACH EXPOSURE SCENARIO FOR RME AND CTE

EXPOSURE SCENARIO	U.S. EPA Acceptable HI	Receptor	Reasonable Maximum Exposure (RME) *	Central Tendency Exposure (CTE) *
ONSITE WORKER	1	Adult	0.1	0.09
OFFSITE CONSTRUCTION WORKER	1	Adult	**2**	0.5
OFFSITE RESIDENT -- WELL A	1	Child	**123**	**74**
		Adult	**53**	**20**
OFFSITE RESIDENT -- WELL B	1	Child	**69**	**41**
		Adult	**30**	**12**
OFFSITE RESIDENT -- WELL C	1	Child	0.06	0.04
		Adult	0.03	0.02
OFFSITE RESIDENT -- WELL D (*WORST CASE SCENARIO*)	1	Child	**124**	**75**
		Adult	**53**	**20**
TRESPASSER	1	Child	0.003	0.001
		Adult	0.002	0.0006

Notes:
Bold underlined values indicate Total HI exceeds U.S. EPA's acceptable level (HI=1).
* All values have been rounded to one significant digit.

8.0 Remedial Action Objectives

The EPA's national goal for the Superfund program is to select remedies that will be protective of human health and the environment, that will maintain protection over time, and that will minimize untreated waste. The NCP identifies the remedial action expectations for contaminated groundwater at Superfund sites as, *"EPA expects to return usable ground waters to their beneficial uses whenever practicable, within a time-frame that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water and evaluate further risk reduction."* 40 C.F.R. § 300.430(a)(1)(iii)(F). Based on this expectation, the following general goals are applicable to groundwater remedial actions.

- Prevent exposure to contaminated groundwater which might pose an unacceptable risk
- Prevent or minimize further migration of the contaminant plume
- Prevent or minimize further migration of COCs from source materials to groundwater
- Return groundwater to expected beneficial uses whenever practicable

The RAOs define the extent of cleanup required to protect human health and the environment and to comply with ARARs. The ARARs are categorized as action specific, chemical specific, and location specific. The ARARs for the Site, divided by category, are attached as Appendix B. The RAOs will identify the environmental media, the COCs, exposure pathways, and potential receptors and target cleanup levels (TCLs) for each pathway/receptor.

The COCs for the Site were selected after review of the BHHRA. A COC is defined as a COPC that contributes significantly to the risk of a receptor that either exceeds a state or federal chemical-specific ARAR or exceeds a 10^{-6} cumulative site cancer risk or non-carcinogenic HI of one. The COPCs not meeting this criterion were not considered to be significant contributors of risk and were not classified as COCs. There are 37 COCs identified for the Site. These chemicals, the observed maximum concentration and concentrations resulting in human health risks greater than 10^{-6} ICLR or an HI = 1, are presented in the following table.

Table 3
Chemicals of Concern (COCs)

	COC	Observed Maximum Concentration (ug/L)	Concentrations (ug/L) resulting in Human Health Risk greater than 10^{-6} ICLR or HI = 1
Detected PCB, VOCs and SVOCs	1,2,4-Trichlorobenzene	62	0.17
	1,3-Dichlorobenzene	100	28
	1,4-Dichlorobenzene	120	2.9
	2-Chlorophenol	9J	8.9
	Aroclor 1260	110	0.002
	Benzene	83	0.97
	Bis(2-Chloroethyl) Ether	6J	0.02
	Bis(2-ethylhexyl)phthalate	120	1.9
	Chlorobenzene	3,200	2.1
	Chloroform	13	0.4
	Naphthalene	8.7J	0.3
	N-Nitrosodi-n-propylamine	8.1J	0.02
	Tetrachloroethene	8.6	0.02
	Trichloroethene	13	0.17
Non-detected PCBs, VOCs, and SVOCs	1,2-Dichloroethane	--	0.22
	1,2-Dichloropropane	--	0.015
	2,4,6-Trichlorophenol	--	0.1
	2,4-Dinitrotoluene	--	0.26
	2,6-Dinitrotoluene	--	0.06
	3,3-Dichlorobenzidine	--	0.74
	4,6-Dinitro-2 Methyl Phenol	--	0.18
	Aroclor 1016	--	0.05
	Aroclor 1221	--	0.13
	Aroclor 1232	--	0.13
	Aroclor 1242	--	0.01
	Aroclor 1248	--	0.02
	Aroclor 1254	--	0.0004
	Benzo(a)anthracene	--	0.05
	Benzo(a)pyrene	--	0.003
	Benzo(b)fluoranthene	--	0.08
	Benzo(k)fluoranthene	--	0.15
	Dibenzo(a,h)Anthracene	--	0.0009
	Hexachloro-1,3-Butadiene	--	0.05
	Hexachlorobenzene	--	0.01
	Indeno(1,2,3-cd)Pyrene	--	0.04
	Nitrobenzene	--	0.18
	Pentachlorophenol	--	0.13
	Vinyl Chloride	--	0.21

Groundwater TCLs were developed to be protective of human health and to comply with chemical-specific ARARs. Additionally, the TCLs were compared to the practically attainable analytical reporting limits to ensure that compliance could be confirmed. The identified TCLs are equivalent to the MCL for COCs which have established federal or state MCLs. For COCs without promulgated MCLs, the TCL was chosen to be equivalent to water quality standards (WQS) or groundwater target concentrations (GTARC), whichever is greater. The proposed TCLs for the Site are summarized in Table 4.

The following are RAOs for groundwater at the Site:

- Prevent exposure of receptors, both in the upland and wetland areas, to fractured bedrock and alluvial groundwater when COC concentrations exceed TCLs
- Prevent future use of the aquifer underlying the Site as a source of drinking water
- Assess and manage the migration of COCs in the fractured bedrock and alluvial groundwater
- Assess and manage the migration of COCs from fractured bedrock into the alluvium

Table 4

Chemicals of Concern (COCs) and Target Cleanup Levels (TCLs)

	COCs	Calculated Concentration resulting in a Human Health Risk [1]	Potential TCLs					Proposed TCLs (ug/L)	Basis for Proposed TCLs
			ARARs				RL[2] (ug/L)		
			SDWA MCL (ug/L)	MDNR MCL (ug/L)	MDNR WQS (ug/L)	MDNR GTARC (ug/L)			
Detected PCB, VOCs and SVOCs	1,2,4-Trichlorobenzene	0.17	70	70	70	70	0.40	**70**	MCL
	1,3-Dichlorobenzene	28	--	--	--	--	1.20	**28**	Risk based
	1,4-Dichlorobenzene	2.9	75	75	75	75	0.30	**75**	MCL
	2-Chlorophenol	8.9	--	--	0.1	40	10	**10**	RL
	Aroclor 1260	0.002	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL
	Benzene	0.97	5	5	5	5	0.40	**5**	MCL
	Bis(2-Chloroethyl) Ether	0.02	--	--	0.3	0.03	10	**10**	RL
	Bis(2-ethylhexyl)phthalate	1.9	--	--	6	6	10	**10**	RL
	Chlorobenzene	2.1	100	100	--	100	0.40	**100**	MCL
	Chloroform	0.4	--	--	--	80	0.30	**80**	GTARC
	Naphthalene	0.3	--	--	--	100	10	**100**	GTARC
	N-Nitrosodi-n-propylamine	0.02	--	--	--	--	10	**10**	RL
	Tetrachloroethene	0.02	5	5	5	5	1.40	**5**	MCL
	Trichloroethene	0.17	5	5	5	5	1.90	**5**	MCL
Non-detected PCBs, VOCs, and SVOCs	1,2-Dichloroethane	0.22	5	5	5	5	5	**5**	MCL
	1,2-Dichloropropane	0.015	5	5	--	5	5	**5**	MCL
	2,4,6-Trichlorophenol	0.1	--	--	2	0.3	10	**10**	RL
	2,4-Dinitrotoluene	0.26	--	--	0.11	0.05	10	**10**	RL
	2,6-Dinitrotoluene	0.06	--	--	--	0.05	10	**10**	RL
	3,3-Dichlorobenzidine	0.74	--	--	0.04	0.04	20	**20**	RL
	4,6-Dinitro-2 Methyl Phenol	0.18	--	--	--	--	50	**50**	RL
	Aroclor 1016	0.05	0.5	0.5	0.000045	0.5	1	**1**	RL>MCL
	Aroclor 1221	0.13	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL
	Aroclor 1232	0.13	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL
	Aroclor 1242	0.01	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL
	Aroclor 1248	0.02	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL

	COCs	Calculated Concentration resulting in a Human Health Risk [1]	Potential TCLs					Proposed TCLs (ug/L)	Basis for Proposed TCLs
			ARARs				RL[2] (ug/L)		
			SDWA MCL (ug/L)	MDNR MCL (ug/L)	MDNR WQS (ug/L)	MDNR GTARC (ug/L)			
	Aroclor 1254	0.0004	0.5	0.5	0.000045	0.5	0.5	**0.5**	MCL
Non-detected PCBs, VOCs, and SVOCs	Benzo(a)anthracene	0.05	--	--	--	0.0044	10	**10**	RL
	Benzo(a)pyrene	0.003	0.2	0.2	0.2	0.2	10	**10**	RI>MCL
	Benzo(b)fluoranthene	0.08	--	--	0.0044	0.0044	10	**10**	RL>GTARC
	Benzo(k)fluoranthene	0.15	--	--	0.0044	0.0044	10	**10**	RL>GTARC
	Dibenzo(a,h)Anthracene	0.0009	--	--	0.0044	0.0044	10	**10**	RL>GTARC
	Hexachloro-1,3-Butadiene	0.05	--	--	--	--	10	**10**	RL>GTARC
	Hexachlorobenzene	0.01	1	1	1	1	10	**10**	RL>MCL
	Indeno(1,2,3-cd)Pyrene	0.04	--	--	0.0044	0.0044	10	**10**	RL>GTARC
	Nitrobenzene	0.18	--	--	17	17	10	**17**	GTARC
	Pentachlorophenol	0.13	1	1	1	1	50	**50**	RL>MCL
	Vinyl Chloride	0.21	2	2	2	2	5	**5**	RL>MCL

Abbreviations:

ARARs Applicable or Relevant and Appropriate Requirement
COC Chemical of Concern
GTARC Groundwater Target Cleanup Levels
HI Hazard Index
ILCR Incremental Lifetime Cancer Risk
MCL Maximum Contaminant Level
MDNR Missouri Department of Natural Resources
RL Reporting Limit
SDWA Safe Drinking Water Act
TCLs Target Cleanup Levels
ug/L Microgram per liter

Notes:

[1] Concentrations represent an ICLR or HI outside EPA's acceptable risk range (HI >1 and ICLR > 10^{-4} to 10^{-6}).

[2] Analytical RLs presented for VOCs and PCBs are one order of magnitude greater than the method detection limits (MDLs) detailed in EPA's SW-846 documentation for Methods 8260B (for VOCs) and 8082 (for PCBs). Analytical RLs presented for SVOCs are equivalent to the estimated quantitation limits (EQLs) detailed in SW-846 documentation for Methods 8270C.

9.0 Description of Alternatives

The Settling Defendants performed a FS to develop and evaluate alternatives for addressing the groundwater contamination at the Site. The remedial alternatives that received a detailed evaluation in the FS are identified below. Alternatives that address groundwater contamination in the fractured bedrock are identified with a "FB" prefix, while those alternatives that address groundwater contamination in the alluvium are identified with an "AL" prefix. Identification numbers match those presented in the FS. All costs and implementation times are estimates.

The Settling Defendants prepared a report titled, "Fractured Bedrock Technical Impracticability Evaluation Report" to assess the ability of technologies currently available to address the groundwater contamination in the fractured bedrock. This report is dated June 2005. The report concludes that there are currently no technologies available to remediate the fractured bedrock groundwater contamination.

For contaminated groundwater in the fractured bedrock, the following alternatives were retained:

- Alternative FB-1 No Action
- Alternative FB-2 Limited Action

For contaminated groundwater in the alluvium, the following alternatives were retained:

- Alternative AL-1 No Action
- Alternative AL-2 Limited Action
- Alternative AL-3 Collection
- Alternative AL-4 Discharge
- Alternative AL-5 In-situ Treatment

Certain parameters needed for response alternative evaluation were not readily available. Estimates or assumptions were made for these parameters. These assumptions, quantity of groundwater impacted, important ARARs, and future anticipated land use were identical for all response alternatives. The quantity of impacted groundwater was estimated to be about 320,000 gallons (this is likely an underestimate since some COCs are sorbed to soil or aquifer particles and may be a continuing source of contamination). The key ARARs are a combination of chemical-specific, action-specific, and location-specific requirements. The ARARs are identified in Tables B-1, B-2, and B-3. Land use in the area was assumed to be predominately commercial/industrial with a possibility of a "special use" residential use within the wetland area.

Pursuant to Section 121(c) of CERCLA and the NCP, the response actions performed at the Site will be reviewed every five (5) years to evaluate whether or not they continue to be protective of human health and the environment. The EPA has interpreted Section 121(c) of CERCLA, as codified in the NCP [40 C.F.R. §300.430(f)(4)(ii)] in the following manner:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted

exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action."

9.1 Fractured Bedrock Groundwater

Technical Impracticability (TI) Waiver

The highly variable and complex nature of the fractured bedrock at the MEW Site is such that any attempt to remediate the contamination will likely worsen the problem. The June 2005 "Fractured Bedrock Technical Impracticability Evaluation Report" provides an in-depth discussion with regards to why remediation of the fractured bedrock groundwater contamination cannot be achieved with technologies currently available. Therefore, a TI waiver for chemical-specific ARARs will be a component of the selected action for fractured bedrock groundwater. This TI waiver will apply only to the groundwater contained in the fractured bedrock. The area to which the TI waiver applies is approximately identified on Figure 4 and is designated as the "Upland Area".

9.1.1 FB-1 No Action

This action was retained as required by section 300.430(e)(3)(ii)(6) of the NCP. This action provides a baseline with which to compare other response actions. "No Action" entails no activities to contain or address COCs at the Site, provides no treatment of COCs, and provides no legal or administrative protection of human health or the environment. "No Action" assumes that physical conditions at the Site remain unchanged.

No RAOs would be achieved using this alternative. Since no additional work would be performed, there would be no implementation requirements. Contamination from the Site would remain unchanged. No time would be needed to construct the alternative, and no costs would be associated with implementation of this alternative.

9.1.2 FB-2 Limited Action

This alternative as proposed will include four (4) components: TI waiver for chemical-specific ARARs, ICs, wellhead treatment, and long-term groundwater monitoring. Information for each of these components is provided below.

Since it is not technically practicable from an engineering perspective to remediate the fractured bedrock groundwater, attainment within the fractured bedrock groundwater area of the Safe Drinking Water Act (SDWA) MCLs (40 CFR §141.11 – 141.14), revised MCLs (40 CFR §141.61 – 141.62) and non-zero Maximum Contaminant Level Goals (MCLGs) (40 CFR §141.60 – 141.51) are waived for 1,1,1-TCA; TCE; PCE; 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; chlorobenzene; 1,2,4-TCB; 1,2-DCB; 1,3-DCB; 1,4-DCB; and PCBs.

The ICs will be implemented to enhance the effectiveness of the engineered controls. The owner of the MEW, Inc. property has recorded a certified copy of a Consent Decree entered into between the U.S. and MEW, Inc. with the Recorder of Deeds of Cape Girardeau County, Missouri. This Consent Decree contains Site activity and use limitations. In particular, this Consent Decree contains a Declaration of Covenants and Restrictions that:

- prohibits residential or agricultural use of the Site
- prohibits Site use for educational, recreational, day care, or rehabilitative use
- prohibits the installation or use of wells for drinking or irrigation water uses
- provides the U.S. with access to the Site
- requires that written notification be provided to EPA prior to any conveyance of the Site
- requires that any instrument of conveyance for the Site contains notification of the requirements of the Consent Decree and the Declaration of Covenants and Restrictions

While this may serve as an effective proprietary control for the Site, additional proprietary controls may be appropriate for the Site as well as for other areas where contaminants have migrated which are not subject to existing controls. It is expected that restrictive covenant or easement will be required for these areas. This instrument will be patterned on either the: 1) Model Restrictive Covenant and Grant of Access found in the MDNR CALM Appendix E, Attachment E1; 2) the proposed Model Declaration of Restrictive Covenant and Grant of Access which is anticipated to be located in the MDNR Long-term Stewardship for Risk-based Corrective Action Sites, Appendix J, Technical Guidance; or 3) other appropriate instruments.

The objectives of imposing additional proprietary controls on the Site are to eliminate or minimize exposures to contamination remaining at the Site and limit the possibility of the spread of contamination. These objectives will be achieved by use of the restrictive covenant or easement as it will: 1) provide notice, 2) limit use, and 3) provide for all required access.

Specifically, the restrictive covenant and easement will achieve this by:

- providing notice to prospective purchasers and occupants that there are contaminants in the groundwater
- ensuring that future owners are aware of engineered controls put into place as part of this remedial action
- prohibiting residential, commercial, and industrial uses, except those uses which will be consistent with the remedial action
- prohibiting or restricting the placement of groundwater wells

- prohibiting other ground penetrating activities which may result in the creation of a hydraulic conduit between water-bearing zones
- providing access to EPA and the state of Missouri for verifying land use
- prescribing actions that must be taken to install and/or maintain engineered controls (if applicable)
- providing access to EPA and the state of Missouri for sampling and the maintenance of engineered controls

The designation of the plume areas as a "special use" area by MDNR's Division of Environmental Quality may also be sought. A "special use" designation will require rulemaking as provided for in the Well Driller's Act, RSMo 256.606. This designation will restrict the placement of wells in areas of groundwater contamination and help ensure that no exposures are created, and that migration of contamination is not enhanced, by the placement of wells in the plume.

Wellhead treatment systems such as activated carbon or air strippers to remove COCs from the drinking water supply will be provided. These systems could be installed and maintained for any existing potable (drinking) water supply well in the event that one becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could be reasonably expected to have COC contamination could also have wellhead treatment systems installed.

Groundwater monitoring will entail sampling and laboratory analysis of COC-impacted groundwater from the 14 existing monitoring wells installed in the bedrock. Laboratory analysis will be required for VOCs, SVOCs, and PCBs for the duration of the monitoring. Annual maintenance and repair of the monitoring wells will be a necessary component. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the RAOs were met or a determination was made that monitoring was no longer necessary.

This alternative relies on ICs, wellhead treatment, and long-term groundwater monitoring to achieve the Site RAOs. The ICs will be established to prohibit or restrict certain Site uses and prohibit the use of untreated contaminated groundwater. The ICs will be supported by wellhead treatment at wells used for drinking water if the wells are impacted by contamination. Monitoring of contaminant movement will be conducted. This alternative is relatively easy to implement and will be protective of human health. Implementation of this alternative will not result in chemical-specific ARAR compliance. It is estimated, based on the results of groundwater modeling, that it will take 30 to 100 years to attain chemical-specific ARARs. Location-specific and action-specific ARARs do not apply to this alternative since no intrusive work is to be performed.

The cost of this alternative is estimated to be $2,248,453 (cumulative net present value). This estimate assumes that the response action will take 30 years to achieve RAOs. Other assumptions used for this cost estimate include: an inflation rate of 3.0 percent, an initial discount rate of 5.0 percent (for the first 15 years), a discount rate of 4.0 percent (for years 16 – 30).

9.2 Alluvium Groundwater

9.2.1 AL-1 No Action

This action was retained as required by section 300.430(e)(3)(ii)(6) of the NCP. This action provides a baseline with which to compare other response actions. "No Action" entails no activities to contain or address COCs at the Site, provides no treatment of COCs, and provides no legal or administrative protection of human health or the environment. "No Action" assumes that physical conditions at the Site remain unchanged.

No RAOs would be achieved using this alternative. Since no additional work would be performed, there would be no implementation requirements. Contamination from the Site would remain unchanged. No time would be needed to construct the alternative, and no costs would be associated with implementation of this alternative.

9.2.2 AL-2 Limited Action

This alternative as proposed will include three (3) components: ICs, wellhead treatment, and long-term groundwater monitoring. Information for each component as envisioned is provided.

The ICs for this alternative will be identical to those discussed above for alternative FB-2.

Wellhead treatment systems, such as activated carbon or air strippers, to remove COCs from drinking water supply will be provided. The systems could be installed and maintained for any existing potable (drinking) water supply well in the event that one becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could reasonably be expected to have COC contamination could also have wellhead treatment systems installed.

Groundwater monitoring will entail sampling and laboratory analysis of COC-impacted groundwater from a number of new and existing monitoring wells installed in the alluvium. The number of wells to be monitored will be determined during the design phase of the response action. The cost estimate for this alternative is based on the assumption that 10 to 12 wells will be monitored. Laboratory analysis for VOCs, SVOCs, and PCBs will be required for the duration of the monitoring. Annual maintenance and repair of the monitoring wells will be necessary. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the RAOs were met or a determination was made that monitoring was no longer necessary.

This alternative relies on ICs, wellhead treatment, and long-term groundwater monitoring to achieve the Site RAOs. The ICs will be established to prohibit or restrict certain Site uses and prohibit the use of untreated contaminated groundwater. The ICs will be supported by wellhead treatment at wells used for drinking water if the wells are impacted by contamination. Monitoring of contaminant movement will be conducted. This alternative is relatively easy to implement and will be protective of human health. Implementation of this alternative would not result in chemical-specific ARAR compliance. It is estimated that it will take up to 30 years to attain chemical-specific ARARs. Location-specific and action-specific ARARs do not apply to this alternative since no intrusive work is to be performed (unless new wells are required).

The cost of this alternative is estimated to be $1,459,393 (cumulative net present value). This estimate assumes that the response action will take 30 years to achieve RAOs. Other assumptions used for this cost estimate include: an inflation rate of 3.0 percent, an initial discount rate of 5.0 percent (for the first 15 years), and a discount rate of 4.0 percent (for years 16–30).

9.2.3 AL-3 Collection

Alternative AL-3 includes all of the AL-2 measures described above. In addition, this alternative provides for targeted groundwater collection, treatment, and discharge. The objective of this alternative is to create a "capture zone" within the COC-impacted alluvium groundwater that will contain the impacted groundwater plume.

This alternative anticipates removing COCs from the extracted groundwater using carbon adsorption technology. The treated groundwater would be discharged to the Cape Girardeau POTW or to Wetland Creek. Implementation of this alternative would require the performance of additional design studies.

This alternative would achieve Site RAOs through a combination of physical removal of COC-impacted groundwater, ICs, wellhead treatment, and groundwater monitoring. The time required to attain RAOs is not known, but may exceed 30 years. This alternative is expected to eventually be complaint with ARARs that regulate drinking water. Discharge of the treated groundwater, either to the POTW or to the Wetland Creek, is expected to be compliant with MDNR WQS and fulfill substantive requirements of the National Pollutant Discharge Elimination System (NPDES) permit. Remedial activities within the wetland area include construction of wells, trenching for piping, providing power, construction of the treatment system, and temporary improvements needed to facilitate access of heavy equipment. These activities will be designed such that they are compliant with action-specific and location-specific ARARs.

The cost of this alternative is estimated to be $8,288,101 (cumulative net present value). This estimate assumes that the response action will take 30 years to achieve RAOs. Other assumptions used for this cost estimate include: an inflation rate of 3.0 percent, an initial discount rate of 5.0 percent (for the first 15 years), and a discount rate of 4.0 percent (for years 16–30).

9.2.4 AL-4 Enhanced Bio-Degradation (EBD)

Alternative AL-4 includes all of the AL-2 measures described above. In addition, this alternative provides for the injection into the alluvium aquifer of an agent to enhance bio-degradation (such as a hydrogen-release compound, HRC®) to achieve Site RAOs. Injection of HRC®, or some other form of EBD agent, into the aquifer will stimulate biological activity and accelerate the breakdown of COCs in the alluvial aquifer. The Site RAOs will be achieved through EBD, ICs, wellhead treatment, and groundwater monitoring. The time required to meet RAOs may exceed 30 years. Remedial activities within the wetland area will include construction of injection wells, injection of HRC® or other form of EBD agent, and temporary improvements needed to facilitate injection well construction. These activities will be designed to be compliant with location-specific and action-specific ARARs. This alternative is expected to meet all federal, state, and local ARARs.

The cost of this alternative is estimated to be $4,815,568 (cumulative net present value). This estimate assumes that the response action will take 30 years to achieve RAOs. Other assumptions used for this cost estimate include: an inflation rate of 3.0 percent, an initial discount rate of 5.0 percent (for the first 15 years), and a discount rate of 4.0 percent (for years 16–30).

9.2.5 AL-5 Monitored Natural Attenuation

Alternative AL-5 includes all of the AL-2 measures described above. In addition, this alternative uses MNA to achieve Site RAOs. Natural attenuation refers to a variety of physical, chemical, and biological mechanisms which act to reduce the mobility, toxicity, and/or mass of COCs in groundwater. The MNA provides for the ongoing monitoring of groundwater to evaluate conditions and verify or confirm that natural processes are working to degrade the contamination and achieve TCLs. The viability of using MNA as an appropriate alluvial groundwater remedy must be established. The Office of Solid Waste and Emergency Response has established criteria to be met for MNA responses. As discussed in Section 1.4 above, EPA expects that through additional groundwater sampling conducted prior to the implementation of a remedial action for the contaminated alluvial groundwater, it can be demonstrated that conditions exist that support the use of MNA to achieve RAOs for this groundwater unit. The MNA involves the collection and assessment of data, performance monitoring, and the evaluation of remedy effectiveness and protectiveness of human health and the environment.

AL-5 is expected to be compliant with ARARs; however, the exact amount of time required to achieve compliance is uncertain. This alternative is easy to implement.

The cost of this alternative is estimated to be $3,905,536 (cumulative net present value). This estimate assumes that the response action will take 30 years to achieve RAOs. Other assumptions used for this cost estimate include: an inflation rate of 3.0 percent, an initial discount rate of 5.0 percent (for the first 15 years), and a discount rate of 4.0 percent (for years 16–30).

10.0 Comparative Analysis of Alternatives

The NCP has established nine criteria to be used to evaluate remedial alternatives. Each alternative must be evaluated with regard to these criteria and then compared to each other before a remedy may be selected. These comparisons are provided in tabular form in Tables 5 and 6. The remedy must provide the best balance of trade-offs in this comparative analysis. All of the criteria were used to evaluate the alternatives.

The EPA has determined that the best alternatives to address groundwater contamination at the Site are: 1) for the fractured bedrock contaminated groundwater - FB-2 (Limited Action), and 2) for the contaminated alluvium groundwater - AL-4 (Enhanced Bio-Degradation) *with a contingency* of AL-5 (MNA) if in-situ groundwater conditions capable of sustaining natural attenuation processes are confirmed. Data for this determination will be collected during the remedial design process. The EPA expects that through additional groundwater sampling conducted prior to the implementation of a remedial action for the contaminated alluvium groundwater, it can be demonstrated that conditions exist that support the use of MNA to achieve RAOs for this groundwater unit. If and when that demonstration has been made to EPA and the state's satisfaction, the remedy for this unit will become that described above as AL-5. Until that demonstration has been made, however, AL-4 will be the remedy to be implemented to address contamination in the alluvial aquifer.

The nine criteria identified in the NCP can be divided into three groups: 1) threshold criteria, 2) primary balancing criteria, and 3) modifying criteria. The threshold criteria are: 1) overall protection of human health and the environment, and 2) compliance with ARARs. An alternative must meet both of these criteria to be selected as a remedy. There are, however, circumstances where it is not possible to meet all ARARs; in those situations, an ARAR waiver may be obtained. As provided in section 121(d)(4) of CERCLA, 42 U.S.C. § 9621(d)(4), ARARs may be waived under certain circumstances, including when compliance with an ARAR is technically impracticable from an engineering perspective (the "TI" waiver).

The second category of NCP criteria is the primary balancing criteria. This group consists of five standards by which the response alternative is evaluated. These standards are:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and/or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

The purpose of this group of criteria is to identify the response action which provides the best balance of all five standards.

The third group of criteria is referred to as the modifying criteria. The two standards for this group are state acceptance and public acceptance of the proposed response actions. These criteria were evaluated using communication received from the state of Missouri and citizens of Cape Girardeau or others impacted by the proposed remedial response actions. Questions, comments, or concerns regarding the proposed alternatives were solicited from the state of Missouri and the public.

The state of Missouri has been informed of and concurs with EPA's selection of remedial actions for the Site.

Community acceptance of the preferred alternatives or preferences for other alternatives was evaluated during the comment period for the Proposed Plan. Notice of the Proposed Plan was published in the *Southeast Missourian*, a daily newspaper of general circulation in southeast Missouri, including the Cape Girardeau area, and a public meeting was held in Cape Girardeau on September 8, 2005. A transcript of this meeting is included in the Administrative Record for the Site. No objectives to the preferred alternatives presented in the Proposed Plan were voiced at the public meeting. The public comment period on the Proposed Plan closed on September 19, 2005. No public comments were received.

Table 5

Comparison of Fractured Bedrock Response Alternatives

Alternative[1]	Evaluation Criteria: Threshold Criteria		Balancing Criteria					Modifying Criteria		Evaluation Comments
	Protective of Human Health and the Environment	**Complies with ARARs**	**Long-term effectiveness and permanence**	**Reduction of toxicity, mobility or volume through treatment**	**Short-term effectiveness**	**Ability to Implement**	**Cost[2] (million $, estimate)**	**State Acceptance**	**Community Acceptance**	
FB-1	No	No	No	No	Yes	Yes	$0	No	No	This alternative meets neither of the threshold criteria. No further consideration was given this alternative.
FB-2	Yes	No	Yes	No	Yes	Yes	2.2	Yes	Yes	This alternative provides for overall protection of human health and the environment with ICs. The second threshold requirement of attaining ARARs cannot be met. Due to the highly complex and variable bedrock conditions, attainment of ARARs through containment, collection, treatment or other technologies would be extremely uncertain. A waiver for ARAR attainment due to technical impracticability (TI) is appropriate given the nature of the contamination and site characteristics. This alternative provides for long-term effectiveness. The toxicity, mobility, and volume of the COC contaminants in the fractured bedrock will not be reduced by this technology. There are no short-term risks associated with this alternative. Implementation of this alternative should present no problems. The estimated cost for this alternative is $2,248,543. **This alternative is the preferred remedial alternative for groundwater in fractured bedrock.**

Notes:
[1] FB-1 No Action
FB-2 This alternative as proposed would include four (4) components: IT waiver for chemical-specific ARARs, Institutional Controls (ICs), wellhead treatment, and long-term groundwater monitoring.
[2] The estimated costs were calculated assuming a 30-year term, an inflation rate of 3.0%, an initial discount rate of 5.0%, and a discount rate of 4.0% for years 15 to 30.

Table 6

Comparison of Alluvium Response Alternatives

Alternative[1]	Evaluation Criteria: Threshold Criteria: Protective of Human Health and the Environment	Complies with ARARs	Balancing Criteria: Long-term effectiveness and permanence	Reduction of toxicity, mobility or volume	Short-term effectiveness	Ability to Implement	Cost[2] (million $)	Modifying Criteria: State Acceptance	Community Acceptance	Evaluation Comments
AL-1	No	No	No	No	Yes	Yes	$0	No	No	This alternative meets neither of the threshold criteria. No further consideration was given AL-1.
AL-2	Yes	No	No	No	Yes	Yes	1.5	No	No	This alternative will not comply with ARARs. No further consideration was given to AL-2
AL-3	Yes	Yes	Yes	Yes	Yes	Yes	8.3	No	No	AL-3 satisfies the threshold criteria. It is the most expensive alluvium response alternative. Active pumping to capture the contaminant plume could mobilize contaminants from the fractured bedrock; if this occurs, an increase in the volume of contaminants in the alluvium could result. There could be some risks to the workers installing the capture and treatment system.
AL-4	Yes	Yes	Yes	Yes	Yes	Yes	4.8	Yes	Yes	AL-4 satisfies the threshold criteria. It is the second most expensive response alternative. It provides for long-term affectiveness, reduction of toxicity, mobility, or volume via treatment; there are minimal short-term risks and is relatively easy to implement. **AL-4 is the preferred remedial alternative for groundwater in the alluvium. However, if on-going groundwater monitoring indicates that degradation of the COCs is occurring without the addition of EBD agents, then the preferred alternative will be AL-5.**
AL-5	Yes	Yes	Yes	Yes	Yes	Yes	3.9	Yes	Yes	AL-5 satisfies threshold criteria. It is less expensive than AL-4. It provides for long-term effectiveness, reduction of toxicity, mobility, or volume through treatment; there are minimal short-term risks and is easy to implement. **This alternative is the alternate preferred response action for groundwater in the alluvium.**

Notes:

[1] AL-1 No Action
AL-2 This alternative includes three (3) components: ICs, wellhead treatment, and long-term groundwater monitoring.
AL-3 This alternative includes all actions proposed for AL-2 plus targeted groundwater collection, treatment, and discharge.
AL-4 This alternative includes all actions proposed for AL-2 plus the EBD injection to enhance COC bio-degradation.
AL-5 This alternative includes all actions proposed for AL-2 plus monitoring of natural attenuation processes degrading COCs.

[2] The estimated costs were calculated assuming a 30-year term, an inflation rate of 3.0%, an initial discount rate of 5.0%, and a discount rate of 4.0% for years 15 to 30.

10.1 Fractured Bedrock

10.1.1 Overall Protection of Human Health and the Environment

Alternative FB-1 is not protective of human health and the environment because the exposure pathways to contaminated groundwater would not be addressed. Alternative FB-1 would not restrict or regulate groundwater use. Alternative FB-2 is protective of human health and the environment. This alternative achieves protectiveness by limiting exposure to contaminated groundwater. Exposure restrictions will be accomplished by ICs and wellhead treatment.

10.1.2 Compliance with ARARs

Alternatives FB-1 and FB-2 have no components that would result in the active remediation of groundwater contamination. They will not be compliant with chemical-specific ARARs since no actions are being taken. Location-specific and action-specific ARARs are not relevant as no intrusive remedial activities are proposed (no new wells are envisioned).

A TI waiver is appropriate for the fractured bedrock groundwater unit. This TI waiver is necessary due to the complexity of the fractured bedrock. Attempts were made during the groundwater RI to install monitoring wells at locations which would intercept fractures transporting COCs. Generally, these attempts were unsuccessful. Examination of bedrock exposures (road cuts, naturally occurring outcrops, and quarry walls) provided data for computer models of the fractured bedrock subsurface. These computer models allowed the prediction, with some accuracy, of the number of vertical fractures within a given area. However, the models were unable to precisely locate the majority of the fractures. The efficacy of the active remedial actions is questionable given the complex nature of groundwater flow in the fractures and solution features. The June 2005 report, "Fractured Bedrock Groundwater Technical Impracticability Evaluation Report" describes in detail why active remediation of the fractured bedrock groundwater is not a viable alternative.

10.1.3 Long-Term Effectiveness and Permanence

The COCs will not be reduced with either Alternative FB-1 or FB-2. The risks posed by COCs in the fractured bedrock groundwater will remain for an unknown period of time. Risks posed by the contaminated groundwater will be managed with FB-2 through ICs and wellhead treatment. Protectiveness under FB-2 will be ensured by the indefinite imposition of ICs. Alternative FB-1 does not meet this criterion; however, Alternative FB-2 does satisfy this requirement.

10.1.4 Reduction of Toxicity, Mobility, and/or Volume through Treatment

No reduction of toxicity, mobility, or volume will be achieved with either Alternative FB-1 or FB-2. Accordingly, these alternatives do not satisfy this criterion.

10.1.5 Short-Term Effectiveness

Alternative FB-1 creates no short-term impacts to human health or the environment. Minimal short-term exposure to workers, the public, and the environment may occur during the implementation of Alternative FB-2. Human exposure to COCs is minimized under FB-2 with the required safety precautions for those workers responsible for the long-term groundwater monitoring.

10.1.6 Implementability

Alternative FB-1 is the easiest to implement since no action is being taken. Alternative FB-2 can be readily implemented since monitoring wells needed for long-term monitoring are already in place. No additional above-ground treatment components are anticipated (beyond wellhead treatment, if necessary).

10.1.7 Cost

Alternative FB-1 has no costs. Alternative FB-2 has a projected cumulative net present value, for a 30-year period, of $2,248,543 (within an accuracy of +50 percent to -30 percent).

ESTIMATED COSTS TO IMPLEMENT FRACTURED BEDROCK REMEDIAL ALTERNATIVES

Criteria		Fractured Bedrock Remedial Alternatives	
		Alternative FB-1: No Action	Alternative FB-2: Limited Action[1]
Capital Cost		$0	$0
Annual O&M Cost	2nd year	$0	$155,719
	4th year	$0	$74,074
Total Periodic Cost		$0	$24,778
Total Net Present Value		$0	$2,248,453

[1] Estimated costs are accurate to -30% to +50%

Notes:

1) "Capital Costs" refers to costs associated with alternative design, construction, installation and start-up. All capital costs are assumed to occur in year zero for discounting purposes.
2) "Annual Operation & Maintenance (O&M) Costs" are for routine operation, maintenance and monitoring of the alternative, and include costs for such items as groundwater well monitoring, remedial system operation and maintenance, removal/disposal of treatment residuals, and ongoing project management and technical support.
3) "Total Net Periodic Costs" are the cumulative net present value costs (with an inflation rate of 3.0 percent and an annual discount rate of 5.0 percent for the first 15 years then 4.0 percent thereafter) which occur during the course of an alternative operation which are not routine annual O&M costs, such as five-year reviews.
4) "Total Present Value" is the total alternative costs (including Capital, O&M, and Periodic Costs) with an applied annual discount rate of 5.0 percent and an inflation rate of 3.0 percent.
5) Costs are presented as FS level estimates (the period of system operation and final budget costs are subject to design and subsequent detailed cost review).

10.1.8 State Acceptance

The state of Missouri concurs with the selection of FB-2 for the fractured bedrock groundwater.

10.1.9 Community Acceptance

No comments were received opposing the selected remedy, FB-2, for the fractured bedrock groundwater.

10.2 Alluvium

Alternatives AL-1, AL-2, and AL-5 propose no, or only limited, actions above those already being conducted. These alternatives include no active Site remediation component (beyond wellhead treatment) and varying degrees of monitoring and ICs. Alternatives AL-3 and AL-4 include all the measures identified for Alternative AL-2 plus active remediation components. Extraction, treatment, and discharge of COC-contaminated groundwater are also included in AL-3. Alternative AL-4 includes an enhanced bio-degradation agent to accelerate breakdown of the COCs. Table 6 summarizes the comparative analysis of AL alternatives.

10.2.1 Overall Protection of Human Health and the Environment

Alternative AL-1 is not protective of human health or the environment since exposure to contaminated groundwater would still be possible (an open exposure pathway). Alternatives AL-2, AL-3, AL-4, and AL-5 are each protective of human health and the environment. Each of these alternatives provides for the imposition of ICs and regulation or restriction on groundwater use. Alternatives AL-3 and AL-4 provide for control of COC migration at target locations within the alluvium.

10.2.2 Compliance with ARARS

Alternatives AL-1 and AL-2 do not actively address groundwater contamination. These alternatives are not compliant with chemical-specific ARARs and do not meet this threshold criteria. Location-specific and action-specific ARARs are not applicable since no response action will occur.

Alternatives AL-3, AL-4, and AL-5 are all expected to comply with chemical-specific ARARs. The time required to achieve compliance is not known; but for purposes of this ROD, the duration is estimated to be at least 30 years. Location-specific and action-specific ARARs could apply to these response actions. Design criteria for these alternatives will be such that compliance with location-specific and action-specific ARARs is achieved.

10.2.3 Long-Term Effectiveness and Permanence

Reduction of the contaminant concentrations is not attained with either Alternative AL-1 or AL-2. Residual risks for COCs in groundwater will remain for an unknown period. The risk from the contaminated groundwater is managed with Alternative AL-2 through ICs and wellhead treatment, although the ICs will be required for an indefinite period to ensure protectiveness. Long-term protectiveness is not attained with Alternative AL-1; however, Alternative AL-2 satisfies this criterion.

Reduction of the contaminant concentrations is expected to occur to varying degrees with Alternatives AL-3, AL-4, and AL-5. Alternative AL-3 achieves COC reduction by creating a capture zone that encompasses the COC-impacted alluvial groundwater; this action may induce an acceleration of the COC migration from the bedrock to the alluvium. Alternative AL-4 achieves COC reduction by the addition of an EBD agent. The EBD agent, functioning as anticipated, will speed up the degradation of the COC mass. Alternative AL-5 achieves COC reduction by relying on naturally occurring chemical actions. Alternatives AL-3, AL-4, and AL-5 each meet this criterion.

10.2.4 Reduction of Toxicity, Mobility, and/or Volume Through Treatment

Reduction of the toxicity, mobility, or volume of COCs is not achieved under either Alternative AL-1 or AL-2. Alternative AL-3 uses physical processes to remove COCs from the alluvial groundwater to reduce concentrations to TCLs. It also has the potential to reduce the volume of COCs and their toxicity. However, the removal of large volumes of groundwater from the alluvium by aggressive pumping could increase groundwater flow from the upgradient fractured bedrock resulting in the increased migration of contamination from the fractured bedrock into the alluvium. Reductive dehalogenation processes are used in both Alternative AL-4 and AL-5 to reduce the mass of COCs in groundwater and achieve TCLs. The effectiveness of AL-4 and AL-5 depends on the suitability of the Site's geochemical and biological conditions for biodegradation of chlorinated solvents. Alternatives AL-3, AL-4, and AL-5 meet this criterion.

10.2.5 Short-Term Effectiveness

No short-term impacts to human health are created by Alternative AL-1 because no action is performed. Minimal short-term impacts to workers, the public, and the environment are anticipated during the implementation of Alternatives AL-2 and AL-5. Human exposures to COCs under these alternatives result from long-term groundwater monitoring activities.

Alternative AL-3 is anticipated to pose the greatest short-term impact to workers, the public, and the environment during implementation. Installation of extraction wells could result in exposure to contaminated soil cuttings and liquids. This alternative has above-ground treatment components which will require construction and operation. There is a potential for direct contact with COCs during carbon change-out and sampling activities.

Alternative AL-4 may result in short-term impacts to workers, the public, and the environment. These impacts could be caused by worker exposure to chemicals during drilling operations, working with groundwater above ground, and EBD injection.

10.2.6 Implementability

Alternatives AL-1, AL-2, and AL-5 are all easy to implement. Alternative AL-1 will be the easiest to implement since no action will be performed.

Implementation of Alternative AL-3 may require additional field work to determine the location of extraction wells, installation of the extraction wells, construction and operation of the treatment components, and discharge of the treated groundwater. This alternative is considered to be the most difficult to implement.

Alternative AL-4 implementation will likely require additional work to determine the location of injection wells. Once the wells are installed, the EBD agent will need to be routinely injected into the groundwater. This alternative will be relatively easy to implement.

10.2.7 Cost

Alternative AL-1 has no costs associated with its implementation, as no action is being performed. Costs for the remaining alluvium alternatives ranked from lowest to highest are:

- AL-2 $1,459,393
- AL-5 $3,905,536
- AL-4 $4,815,568
- AL-3 $8,288,101

ESTIMATED COSTS TO IMPLEMENT ALLUVIUM REMEDIAL ALTERNATIVES

Criteria		Alluvium Remedial Alternatives				
		Alternative AL-1: No Action	Alternative AL-2: Limited Action[1]	Alternative AL-3: Groundwater Extraction, Treatment and Discharge[1]	Alternative AL-4: Enhanced Biodegradation by HRC Injection[1]	Alternative AL-5: Monitored Natural Attenuation[1]
Capital Cost		$0	$0	$485,692	$0	$0
Annual O&M Cost	2nd year	$0	$97,324	$412,165	$327,174	$278,347
	4th year	$0	$46,922	$272,259	$121,995	$134,196
Total Periodic Cost		$0	$24,778	$24,778	$24,778	$24,778
Total Net Present Value		$0	$1,459,393	$8,288,101	$4,815,568	$3,905,536

1 Estimated costs accurate to -30 percent to +50 percent

Notes:

1) "Capital Costs" refers to costs associated with alternative design, construction, installation and start-up. All capital costs are assumed to occur in year zero for discounting purposes.

2) "Annual O&M Costs" are for routine operation, maintenance and monitoring of alternative, and include costs for such items as groundwater well monitoring, remedial system O&M, removal/disposal of treatment residuals, and ongoing project management and technical support.

3) "Total Net Periodic Costs" are the cumulative net present value costs (with an inflation rate of 3.0 percent and an annual discount rate of 5.0 percent for the first 15 years then 4.0 percent thereafter) which occur during the course of an alternative operation which are not routine annual O&M costs, such as five-year reviews.
4) "Total Present Value" is the total alternative costs (including Capital, O&M, and Periodic Costs) with an applied discount rate of 5.0 percent and an inflation rate of 3.0 percent.
5) Costs are presented as FS level estimates (the period of system operation and final budget costs are subject to design and subsequent detailed cost review).

10.2.8 State Acceptance

The state of Missouri concurs with the selection of AL-4 as the primary remedy for addressing contaminated groundwater in the alluvium, and in the selection of AL-5 as the contingent remedy should conditions exist in the alluvial groundwater that result in natural degradation of the COCs.

10.1.9 Community Acceptance

No comments were received opposing the selected remedy, AL-4 with the contingency of AL-5, for groundwater in the alluvium.

11.0 Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site whenever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which typically cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

Principal threat wastes, PCB-contaminated soils, at the Site have been addressed. PCB-contaminated soils were excavated and thermally treated during the Soil Remedial Action. This treatment satisfies the statutory preference for treatment of principal threat wastes.

12.0 Selected Remedy

Two groundwater regimes have been impacted by contamination from the Site. The impacted groundwater is in the fractured bedrock in the upland area and in the alluvium in the wetland area. A remedy has been identified for each groundwater regime.

12.1 Fractured Bedrock

Remedial action FB-2 as proposed will include four (4) components: TI waiver for chemical-specific ARARs, ICs, wellhead treatment, and long-term groundwater monitoring. The TI waiver is needed due to the highly variable and fractured nature of the bedrock in the upland area of the site. As anticipated, the ICs will be implemented or imposed as appropriate to prevent exposure to the contaminated groundwater. The primary IC is expected to be proprietary in nature, i.e., a restrictive covenant and grant of access. Other ICs that might be used include the designation of the area of groundwater contamination as a "special use" area by MDNR's

Division of Environmental Quality, the use of ordinances, inspection regimes, property notices, and/or public information.

Wellhead treatment systems, such as activated carbon or air strippers, to remove COCs from the drinking water supply will be provided. The systems could be installed and maintained for any existing potable (drinking) water supply well in the event that one becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could be reasonably expected to have COC contamination could also have wellhead treatment systems installed.

Monitoring of groundwater will be performed. This will be accomplished by obtaining groundwater samples from bedrock wells and performing laboratory analysis on the samples for COCs. Laboratory analysis for the duration of the monitoring is expected to include VOCs, SVOCs, and PCBs. Annual maintenance and repair of the monitoring wells will be required. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the RAOs were met or a determination was made that monitoring was no longer necessary.

Remedial action FB-2 provides for overall protection of human health and the environment with ICs. However, FB-2 does not meet the second threshold requirement of attaining ARARs. Due to the highly complex and variable bedrock conditions, attainment of ARARs through containment, collection, treatment, or other technologies would be extremely uncertain and costly. A TI waiver for attainment of chemical-specific ARARs is appropriate for remedial action FB-2.

Remedial action FB-2 provides for long-term effectiveness. The toxicity, mobility, and volume of the COCs in the fractured bedrock will not be reduced by this technology. There are no short-term risks associated with this remedial action. Implementation of this remedial action should present no problems.

12.2 Alluvium

Remedial action AL-4 (Enhanced Bio-Degradation) as proposed will consist of four (4) components. These components include ICs, wellhead treatment, long-term groundwater monitoring, and injection of EBD agents into the alluvial groundwater. For cost estimate purposes, the EBD agent was injected only once. Given the fact that contaminated groundwater from the bedrock is exiting into the alluvium, multiple injections of the EBD agent will likely be required.

As anticipated, the ICs will be implemented or imposed as appropriate to prevent exposure to the contaminated alluvial groundwater. The primary IC is expected to be proprietary in nature, i.e., a restrictive covenant and grant of access. Other ICs that might be used include the designation of the area of groundwater contamination as a "special use" area by MDNR's Division of Environmental Quality, the use of ordinances, inspection regimes, property notices, and/or public information.

Wellhead treatment systems, such as activated carbon or air strippers, to remove COCs from groundwater to be used for a drinking water supply will be provided. The systems could be installed and maintained for any existing potable (drinking) water supply well in the event that one becomes impacted by COCs. New water supply wells installed in areas where extracted groundwater could be reasonably expected to have COC contamination could also have wellhead treatment systems installed.

Monitoring of groundwater will be performed. This will be accomplished by obtaining groundwater samples from existing and new alluvial wells. The groundwater samples will be analyzed in the laboratory for COCs. Annual maintenance and repair of the monitoring wells will be a necessary component. Provision will be made for the abandonment of the monitoring wells, pursuant to MDNR requirements, at such time as the RAOs were met or a determination was made that monitoring was no longer necessary.

Agents to accelerate natural biological processes that degrade or break-down COCs will be injected into the alluvial groundwater. Installation of injection wells will be required. Periodic handling of the EBD agent will also be required. Multiple injections may be required as contaminated bedrock groundwater is flowing into the alluvium.

Remedial action AL-4 meets both threshold criteria: it provides for the overall protection of human health and the environment, and complies with ARARs. This remedial action also provides for long-term effectiveness in the alluvial groundwater. The toxicity, mobility, and volume of the COCs in the alluvium will be reduced by the application of this remedial action. Minimal short-term risks associated with injection well installation and EBD injection are possible. Implementation of this remedial action should present no problems. The costs associated with remedial action AL-4 are nearly five (5) million dollars.

Contingent Alluvium Technology

There is very little difference between Alternatives AL-4 and AL-5. Both remedial alternatives rely on degradation of the COCs in the alluvial groundwater to achieve RAOs. The primary difference between AL-4 and AL-5 is that Alternative AL-4 requires the injection of an agent into the groundwater to accomplish COC degradation. The achievement of RAOs for Alternative AL-5 relies on naturally occurring processes and chemicals found in the alluvial groundwater. Quarterly groundwater monitoring continues to be conducted. During June 2005, the analyses performed on alluvial groundwater samples were expanded to include parameters that are used to determine whether or not degradation of chemicals is naturally occurring. It is anticipated that these parameters will continue to be evaluated for at least one year. Evaluation of the data will be performed to determine whether or not the alluvial groundwater can support natural attenuation. If that determination is made, injection of compounds into the groundwater will not be required to attain RAOs. Implementation of AL-5 will cost about one (1) million dollars less than AL-4.

13.0 Statutory Determinations

This section provides a brief description of how the selected remedies satisfy the statutory requirements of section §121 of CRCLA (as required by the NCP §300.430(f)(5)(ii)) and explain the five-year review requirements. The determinations for each selected remedy will be discussed separately.

13.1 Fractured Bedrock

13.1.1 Protection of Human Health and the Environment

The Fractured Bedrock Selected Remedy, Limited Action FB-2, is protective of human health and the environment. This remedy achieves protectiveness with ICs and long-term monitoring. The remedy provides for well-head treatment should a supply well (drinking water or industrial process) be installed. Human exposures to contaminated groundwater will be controlled.

The current cancer risks associated with human consumption of the contaminated groundwater are $1x10^{-3}$, given the chlorobenzene concentrations. Should unfiltered groundwater be used for human consumption the cancer risks from ingestion of PCBs is estimated to be $5x10^{-2}$.

13.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy, FB-2, does not comply with chemical-specific ARARs. The bedrock conditions are highly complex and variable in the upland area. Attainment of ARARs through containment, collection, treatment, or other technologies would be extremely uncertain. A waiver for chemical-specific ARAR attainment due to technical impracticability considerations is a component of the selected remedial action.

Compliance with action-specific ARARs will be achieved. These ARARs will be of interest should any wells be installed in the fractured bedrock. As described, the selected remedy will provide for well-head treatment for any wells installed in the impacted fractured bedrock. Action-specific ARARs include the following.

- SWDA - §1412(b)(4)(E)(ii), which regulates the design, management, and operation of POU or POE treatment units used to achieve compliance with MCLs.
- SDWA, criteria and procedures for public water systems using POE devices (40 CFR §141.100) which establishes criteria and procedures for Public Water Systems using POE devices.
- SDWA, variances and exemptions from MCLs for organic and inorganic chemicals (40 CFR §142.60), which identifies technologies and treatment techniques available to achieve compliance with MCLs.

13.1.3 Cost Effectiveness

The EPA has determined that the Fractured Bedrock Selected Remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition of cost effectiveness was applied: "[a] remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP § 300.430(f)(1)(ii)(D)). The EPA has determined that the costs associated with FB-2 are proportional to its overall effectiveness. This determination is based by evaluating the overall "effectiveness" of the alternatives that satisfied the threshold criteria. Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness). The highly variable and complex nature of the fractured bedrock made consideration of any action other than the selected remedy impracticable due to difficulty, if not impossibility, of successfully extracting contamination from this highly fractured bedrock, as well as the very real likelihood of exacerbating the extent of contamination by mobilizing contamination into the downgradient alluvium. The relationship of the overall effectiveness of this remedial action is proportional to its costs and hence this remedial action represents a reasonable value for the money to be spent. The estimated present worth of the selected remedy is $2,248,453.

13.1.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the Site. The EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria and considering state and community acceptance.

It is EPA's opinion that the source materials for the Site groundwater contamination were permanently destroyed by thermal desorption during the remedial action addressing soil contamination. Deep residual contamination within the fractured bedrock cannot be effectively or practically addressed with any technologies currently available.

13.1.5 Preference for Treatment as a Principal Element

Principal threats were addressed during the remedial action for the contaminated soils. By utilizing treatment as the significant portion of the soils OU, the statutory preference for remedies that employ treatment as a principal element is satisfied. Additionally, the highly complex and variable bedrock makes active treatment of the contaminated groundwater technically impracticable.

13.1.6 Five-Year Review Requirements

Because the remedial action for OU 1, as well as this OU, resulted in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted on or before September 24, 2009 (five years after the first five-year review for the Site). Five-year reviews are conducted to ensure that the remedies are, or continue to be, protective of human health and the environment.

13.2 Alluvium

13.2.1 Protection of Human Health and the Environment

The selected remedy for the alluvium, AL-4, or the contingent remedy, AL-5, are both protective of human health and the environment. AL-4 achieves its protectiveness by in-situ destruction of the COCs, with institutional controls and long-term monitoring. This remedy provides for well-head treatment should a supply well (drinking water or industrial process) be installed. Human exposures to contaminated groundwater will be controlled.

The current cancer risks associated with human consumption of the contaminated groundwater are 4×10^{-3} for an adult living in the wetland area and 7×10^{-3} for a child resident. The HI for a construction worker, working in a subsurface trench and in contact with contaminated groundwater, is 2. The HI for residents, adult and child, is 53 and 123, respectively.

13.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Both the selected remedy, AL-4, and the contingent remedy, AL-5, comply with ARARs. Compliance with action-specific ARARs will be achieved. As described, the selected remedy and the contingent remedy provide for well-head treatment for any wells installed in the downgradient wetland area. The ARARs are presented below and in more detail in Appendix B.

- SDWA – MCLs (40 CFR §141.11 – 141.14). Revised MCLs (40 CFR §141.61 – 141.62) and non-zero MCLGs (40 CFR §141.60 – 141.51). MCLs have been promulgated for a number of common organic and inorganic contaminants in drinking water supply systems.
- NAWQC (33 U.S.C. §1314(a) and 42 U.S.C. § 9621(D)(2) and WQSs (40 CFR §131.36(b) and 131.38) which have been promulgated to protect human health and aquatic life from contamination in surface water bodies.
- Missouri Water Quality Standards (10 CSR 20-7.031) which identifies beneficial uses of water to the state, criteria to protect those uses and defines the anti-degradation policy.
- Public Drinking Water Program Maximum Volatile Organic Chemical Contaminant Levels and Monitoring Requirements (10 CSR 0-4.100) which regulates concentrations of contaminants in public drinking water supply systems.
- CALM – Appendix B (Tier 1 Soil and Groundwater Cleanup Standards) which establishes conservatively-derived, risk-based GTARC for remediation of voluntary cleanup sites in Missouri.
- Protection of Wetlands (Executive Order 11990, 40 CFR Part 6, Appendix A) which requires federal agencies to minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.
- Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR Part 6, Appendix A) requires federal agencies to evaluate the potential effects of an action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.

- RCRA Floodplain Restriction for Hazardous Facilities (40 CFR 264.18(b)) requires that a hazardous waste facility located in a 100-year floodplain be designed, constructed, operated, and maintained to prevent wash-out of any hazardous waste by a 100-year flood.
- Protection of Lakes and Streams Missouri Water Quality Standards (10 CSR 20-7.03) which protects the quality of lakes and streams.
- SWDA - §1412(b)(4)(E)(ii), which regulates the design, management and operation of POU or POE treatment units used to achieve compliance with a MCL.
- Standards Applicable to Transporters of Hazardous Waste (40 CFR Part 263) establishes standards which apply to persons transporting hazardous wastes, requiring a manifest pursuant to 40 CFR Part 262, within the United States.
- SDWA, criteria and procedures for public water systems using POE devices (40 CFR §141.100) which establishes criteria and procedures for Public Water Systems using POE devices.
- SDWA, variances and exemptions from MCLs for organic and inorganic chemicals (40 CFR §142.60), which identifies technologies and treatment techniques available to achieve compliance with MCLs.

Other criteria, advisories, or guidance exist that are not ARARs that are appropriate to the selected remedy or the contingent remedy. These criteria, advisories or guidance are To Be Considered (TBCs). The TBCs are summarized below. They are presented in greater detail in Appendix B.

- EPA Risk RfDs are levels developed by EPA to evaluate incremental human carcinogenic risk as a result of exposure to carcinogens.
- EPA Human Health Assessment CSFs are tools developed to evaluate incremental human carcinogenic risk from exposure to carcinogens.
- EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance establish criteria and provide guidelines for evaluating human health and ecological risks at CERCLA sites.

13.2.3 Cost Effectiveness

The EPA has determined that the Alluvium Selected Remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition of cost effectiveness was applied: "[a] remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP § 300.430(f)(1)(ii)(D)). The EPA has determined that the costs associated with AL-4 are proportional to its overall effectiveness. This determination is based by evaluating the overall "effectiveness" of the alternatives that satisfied the threshold criteria. Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness). The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent. The estimated present worth of the selected remedy, AL-4, is $4,815,568.

The contingent remedy, AL-5, will be implemented if data indicate that the chemistry of the groundwater will degrade the COCs without addition of any other agent(s). This remedy is cost effective and represents a reasonable value for the money to be spent. This decision was made in accordance with the parameters discussed above. The estimated present worth of the contingent remedy, AL-5, is $3,905,536.

13.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the Site. The EPA has determined that the selected remedy or the contingent remedy provides the best balance of trade-offs in terms of the five balancing criteria and considering state and community acceptance.

The EPA's has determined that the source materials for Site groundwater contamination were permanently destroyed by thermal desorption during the remedial action addressing soil contamination. The selected remedy will degrade the COCs in-situ, thereby providing a permanent solution. The contingent remedy will ensure that natural processes are acting to degrade the COCs in-situ, also providing a permanent solution. Both of these remedies will be monitored and evaluated during the long-term monitoring program that is a part of each.

13.2.5 Preference for Treatment as a Principal Element

Principal threats were addressed during the remedial action for the contaminated soils. By utilizing treatment as the significant portion of the soils OU, the statutory preference for remedies that employ treatment as a principal element is satisfied. The selected remedy and contingent remedy both satisfy the preference for treatment. The COCs in the groundwater will be degraded in-situ by either adding agents or relying on natural attenuation processes.

13.2.6 Five-Year Review Requirements

Because the remedial action for OU 1, as well as this OU 2, resulted in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted on or before September 24, 2009 (five years after the first five-year review for the Site). Five-year reviews are conducted to ensure that the remedies are, or continue to be, protective of human health and the environment.

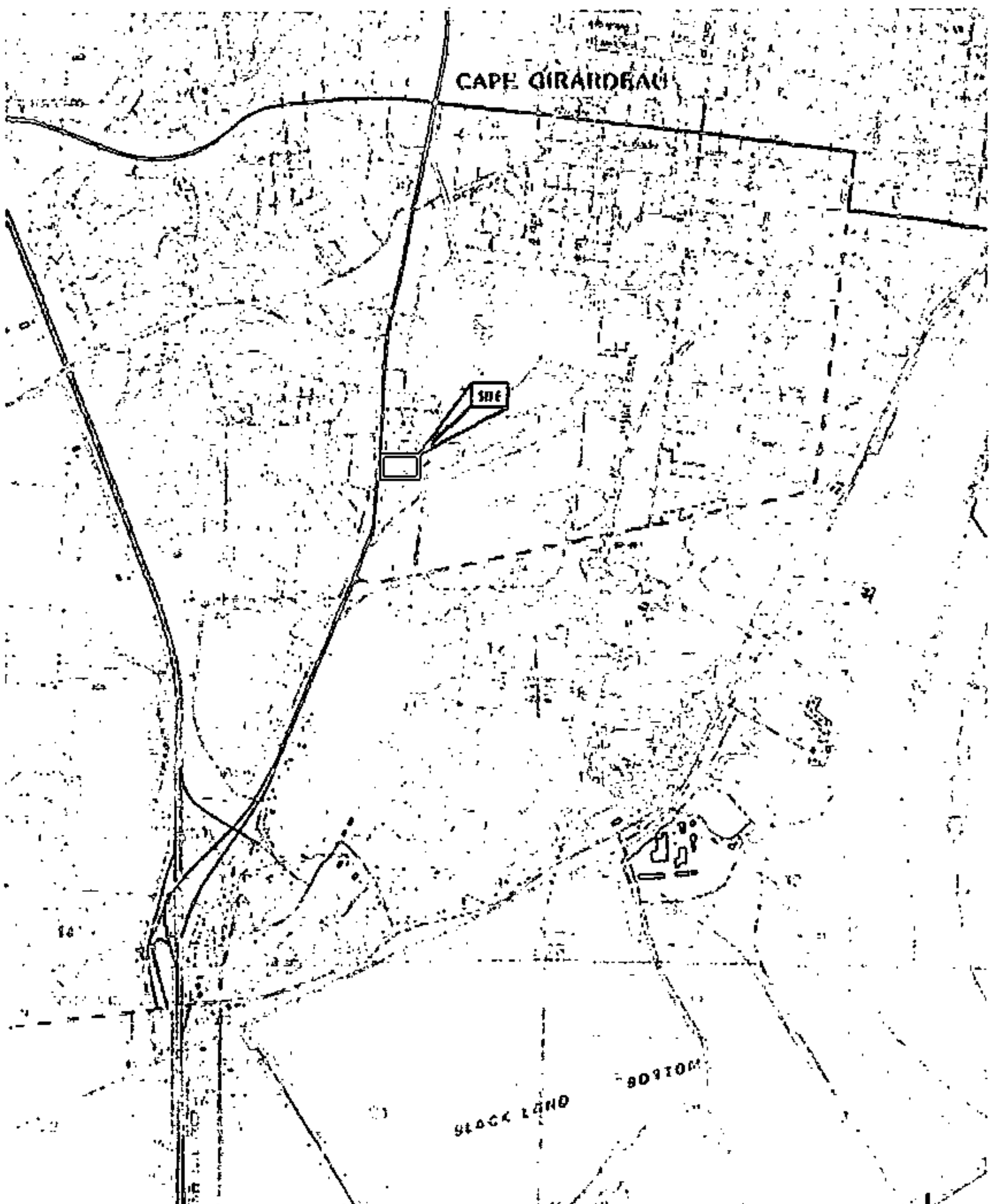
14.0 Documentation of Significant Changes

No significant changes were made to the preferred remedial alternatives as presented in the Proposed Plan for OU 2. The Proposed Plan for OU 2 was made available to the public on August 21, 2005, and discussed during a Public Meeting held in Cape Girardeau, Missouri, on September 8, 2005.

PART III RESPONSIVENESS SUMMARY

No comments on the Proposed Plan for OU 2 were received from the public; the state of Missouri has concurred on the preferred alternatives presented in the Proposed Plan.

FIGURES



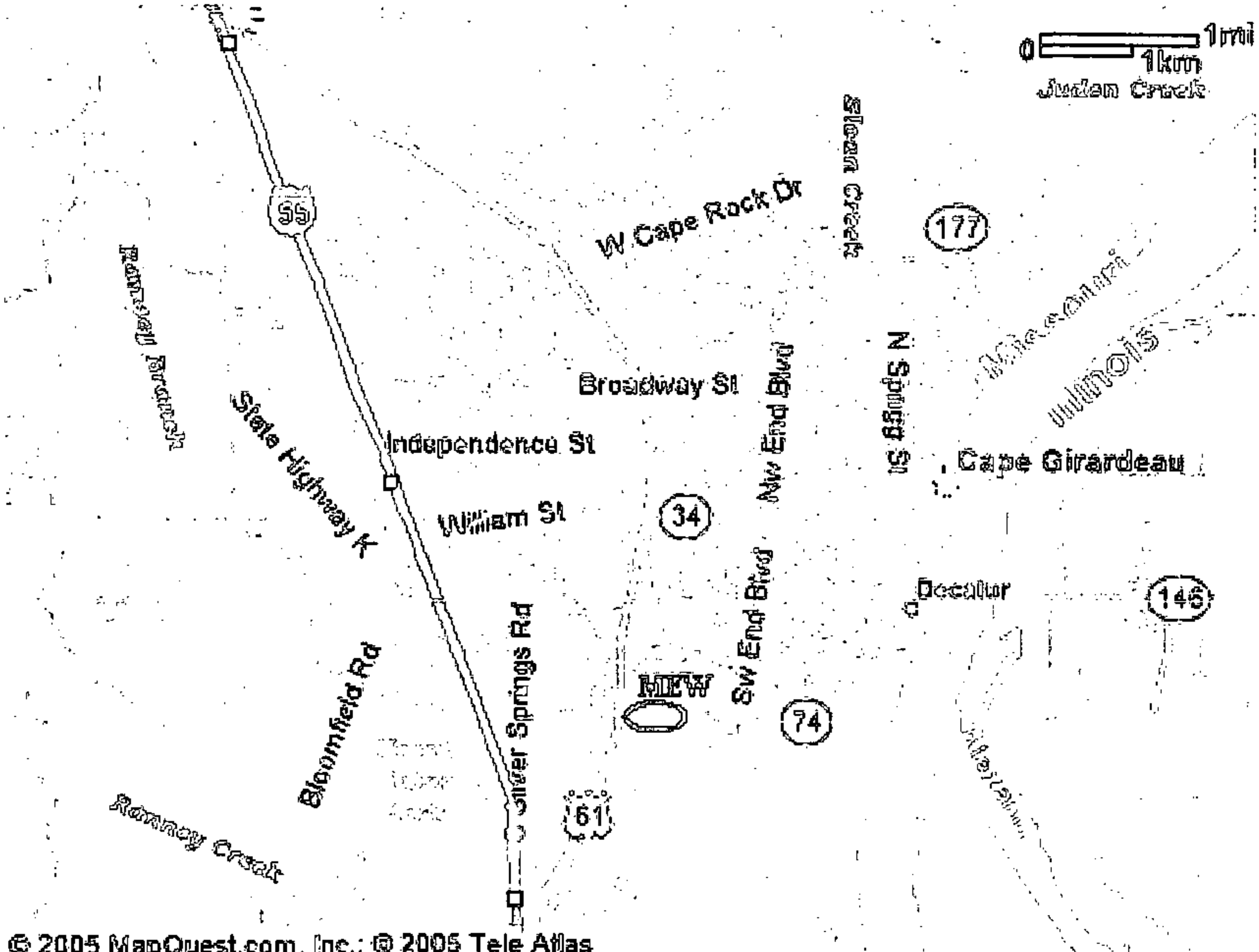
NOTES

1) BASE MAP FROM USGS 7.5 MINUTE CAPE GIRARDEAU QUADRANGLE (1965, REVISED 1993).

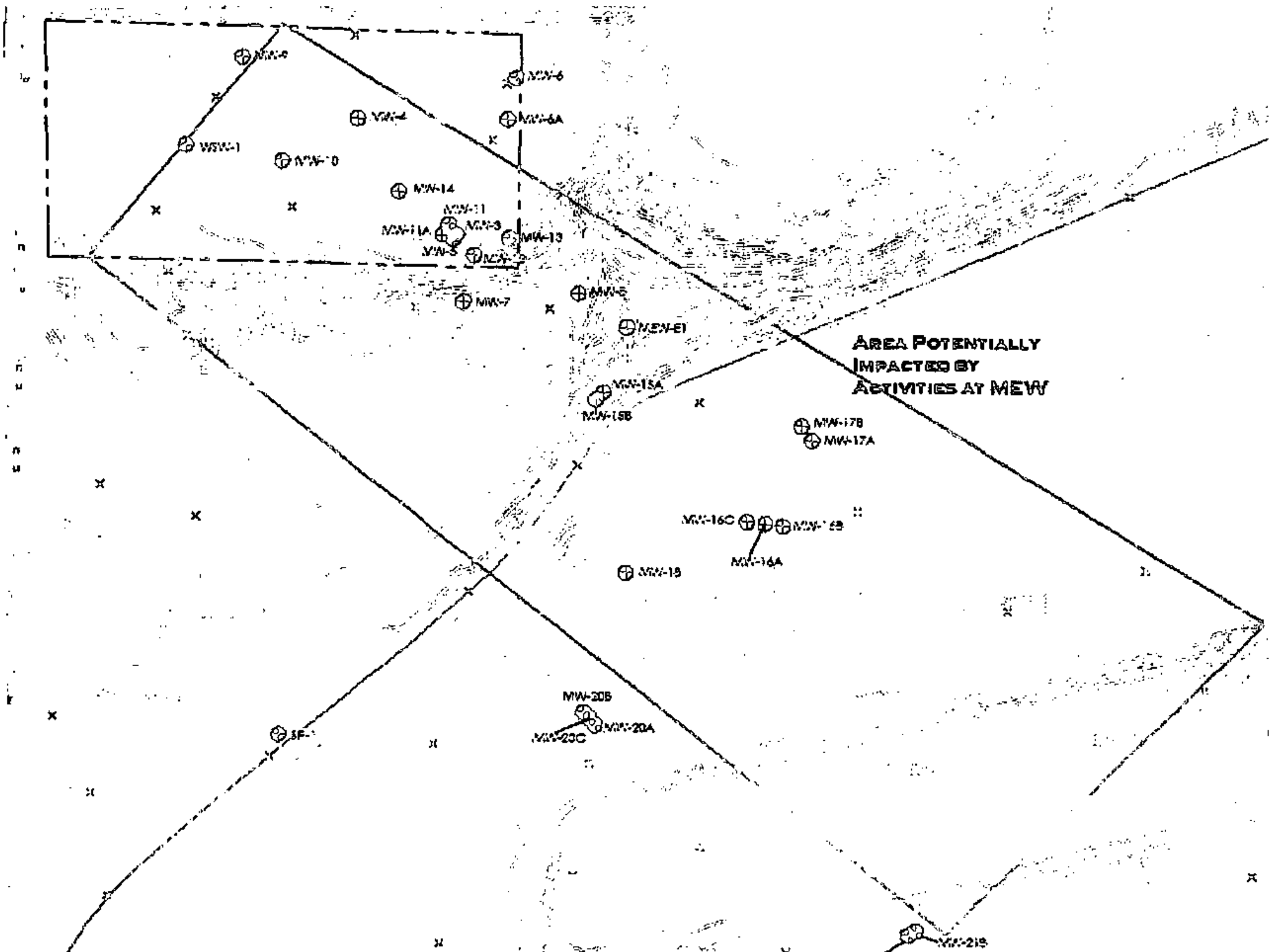
2) ALL LOCATIONS ARE APPROXIMATE.

0 0.5
Approximate Scale in Miles

from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Site Location Map	Figure 1



From 2005 MapQuest.com, Inc.	MISSOURI ELECTRIC WORKS SITE **Site Location within City Limits**	**Figure 2**

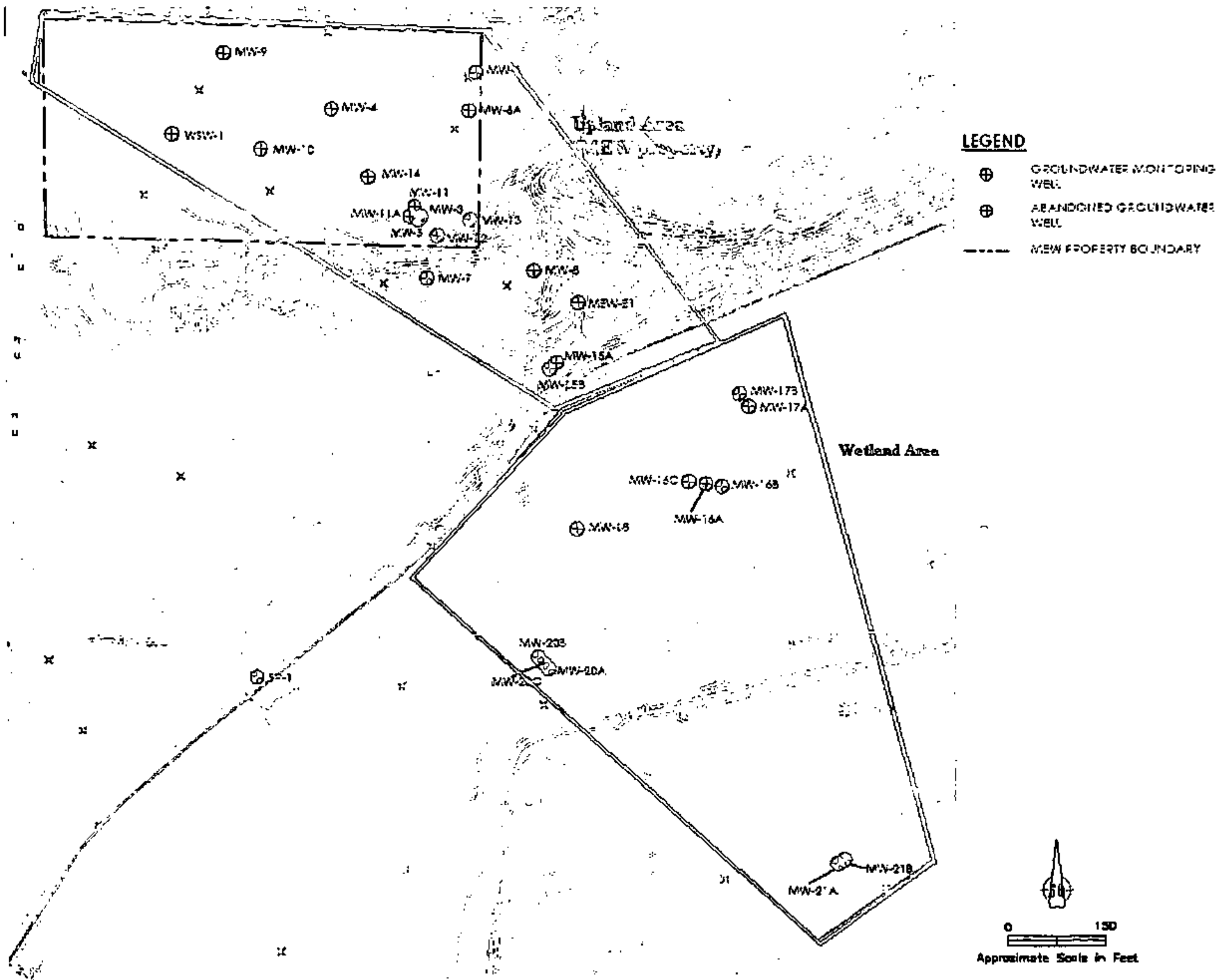


from KOMEX, Remedial Investigation Report, 2005

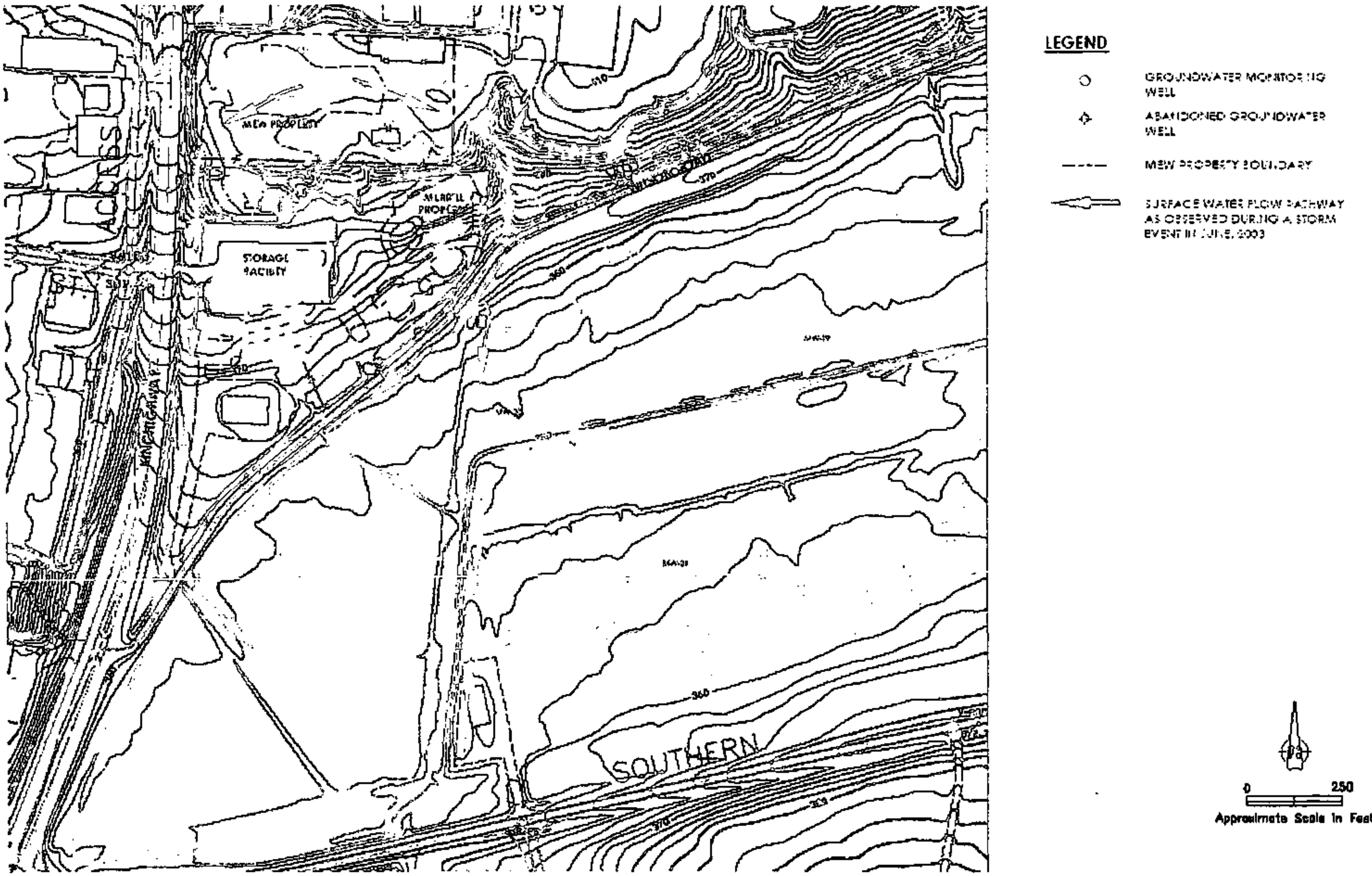
MISSOURI ELECTRIC WORKS SITE

Area Impacted by MEW Activities

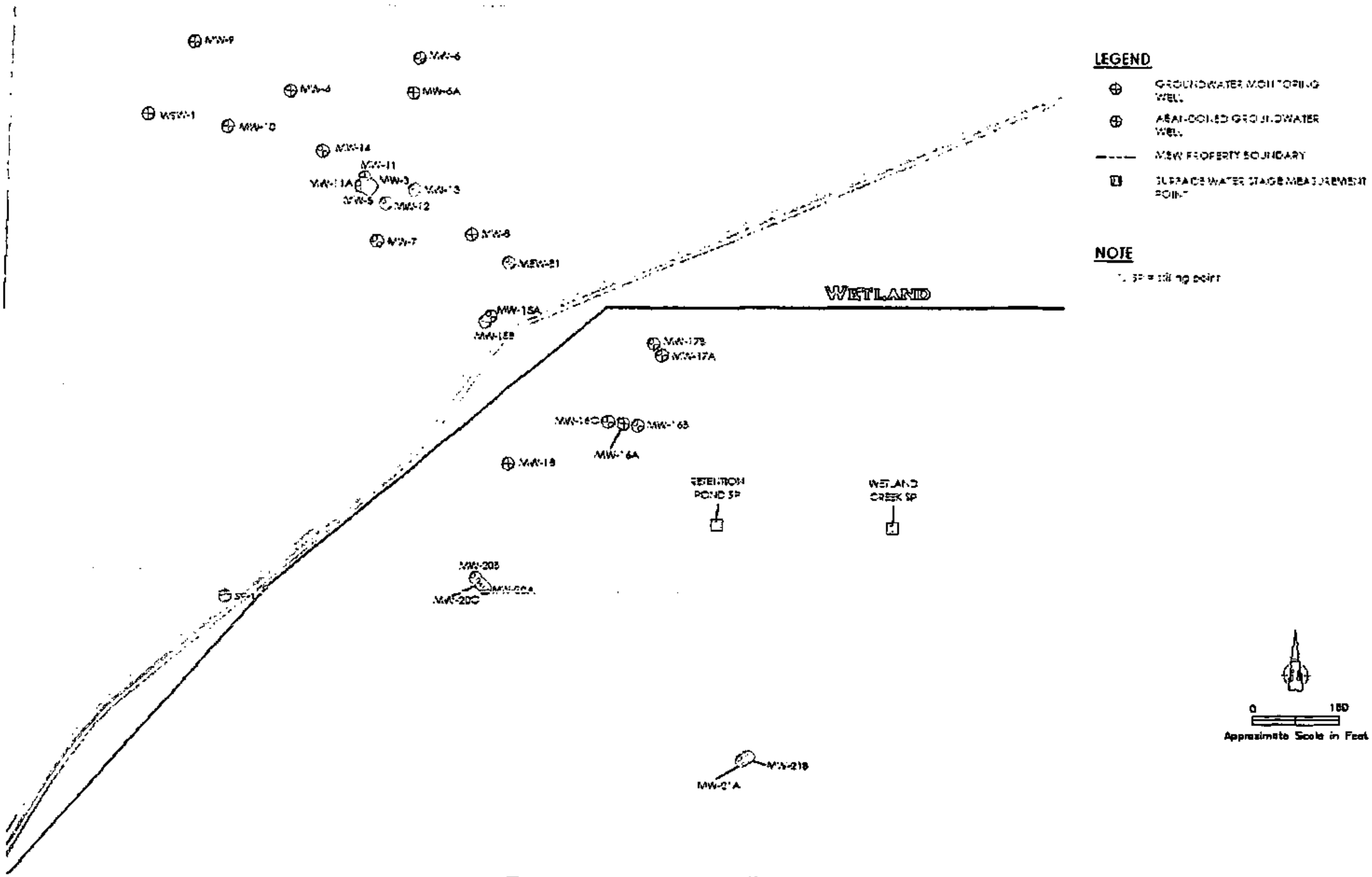
Figure 3



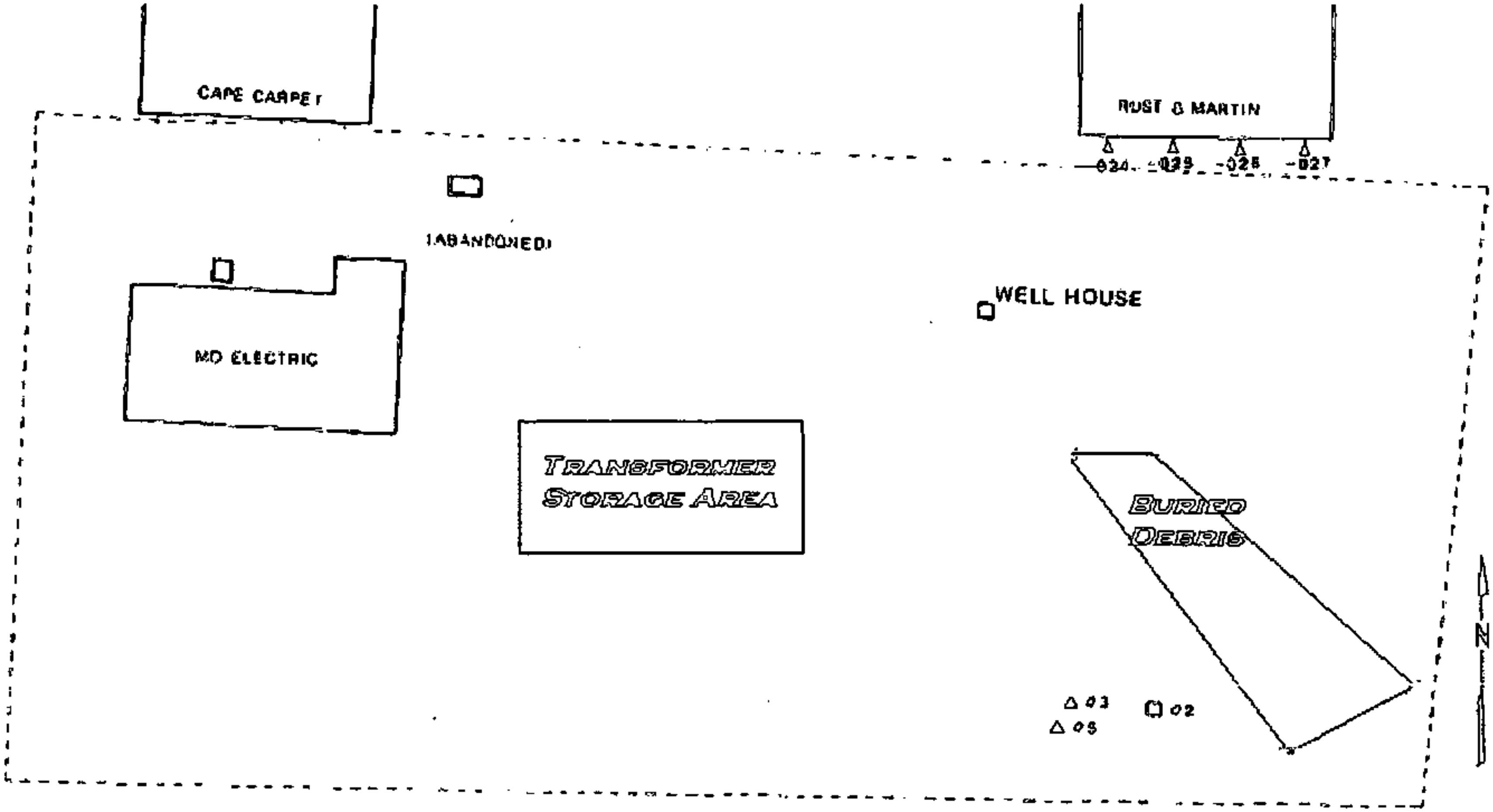
from KOMEX, Remedial Investigation Report, 2005	**MISSOURI ELECTRIC WORKS SITE** **Location of Upland and Wetland Areas**	**Figure 4**



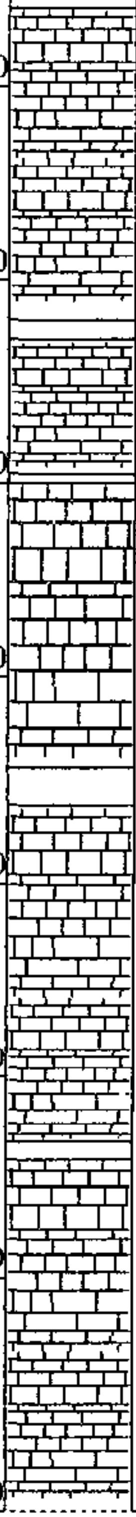
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Surface Drainage Pathways from MEW Property**	**Figure 5**



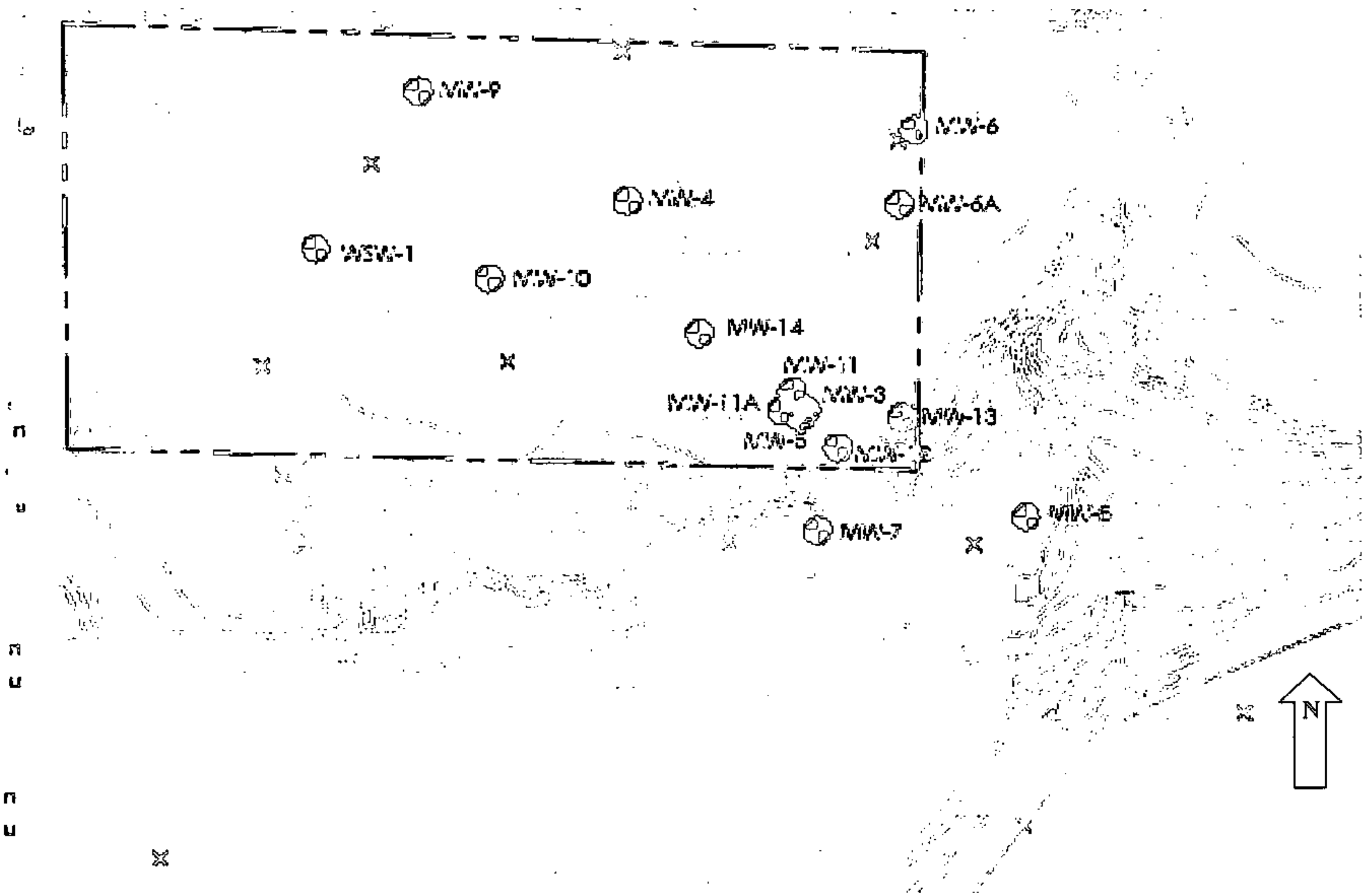
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Wetland Location**	**Figure 6**



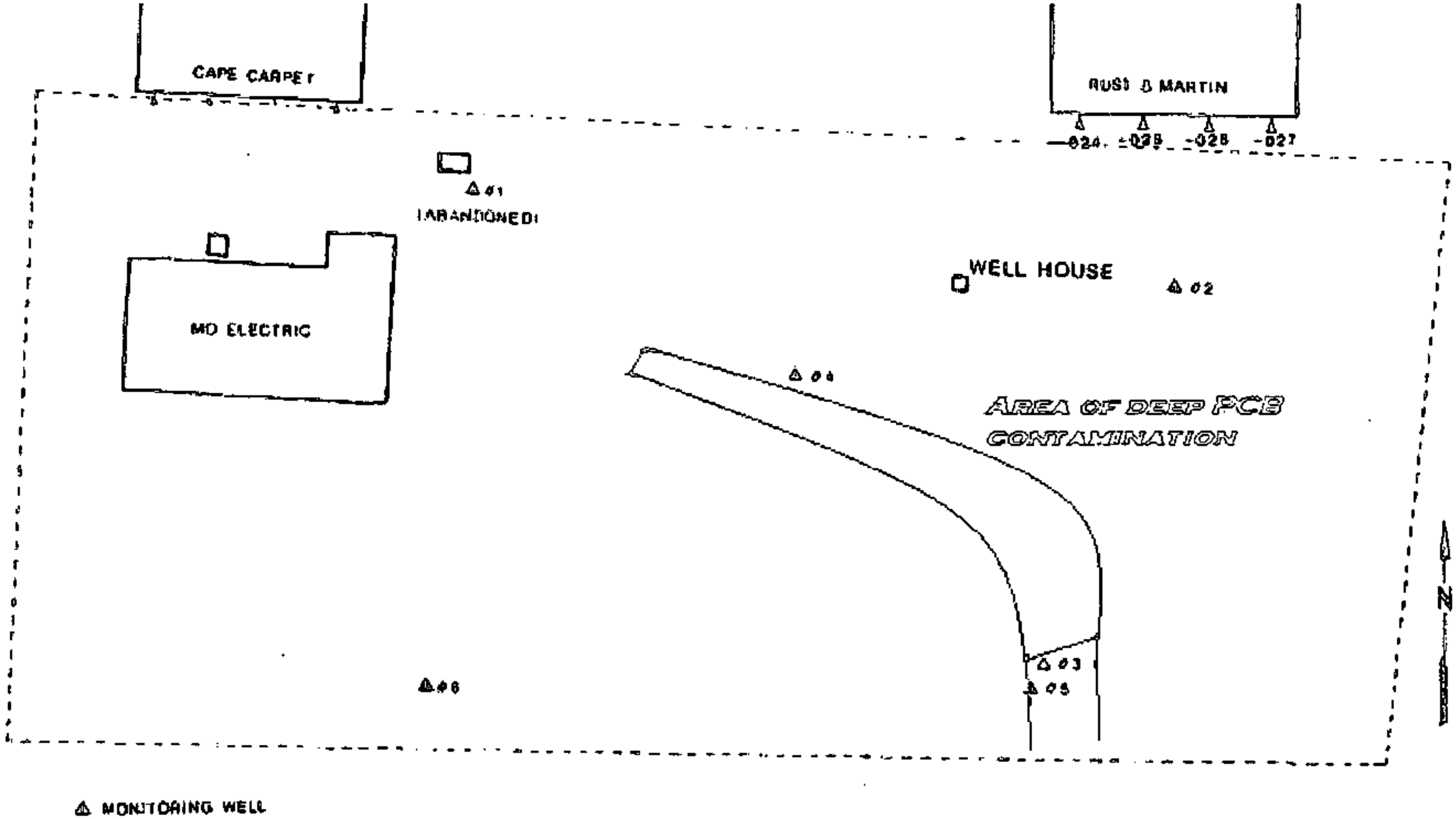
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Former Transformer Storage and Debris Burial Areas**	**Figure 7**

Depth 0	Graphic Log	Lithologic Description
		Reddish Brown, **Silty Clay**
50		**Limestone**: gray, dense, secondary calcite and micrite filling void spaces, trace fossils, trace secondary pyrite, thin clay seam at 36'
100		abundant fossils at 92.5'
		Mud seam from 111.5' to 114.5'
150		Mud seam from 148' to 150'
		Shale laminations present
200		
		Mud seam from 222' to 230'
250		
300		
		Mud seam from 310' to 315'
		Limestone: Gray, dense, secondary calcite and pyrite fillings, shale laminations present
350		
		Tan to brownish limestone from 380' to 381'
400		
	BOB 405'	Total Depth 405'

	MISSOURI ELECTRIC WORKS Subsurface Conditions at MW-11A	Figure 8



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **2000 Monitoring Well System**	**Figure 9**



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Deep PCB Contamination	**Figure 10**

LEGEND

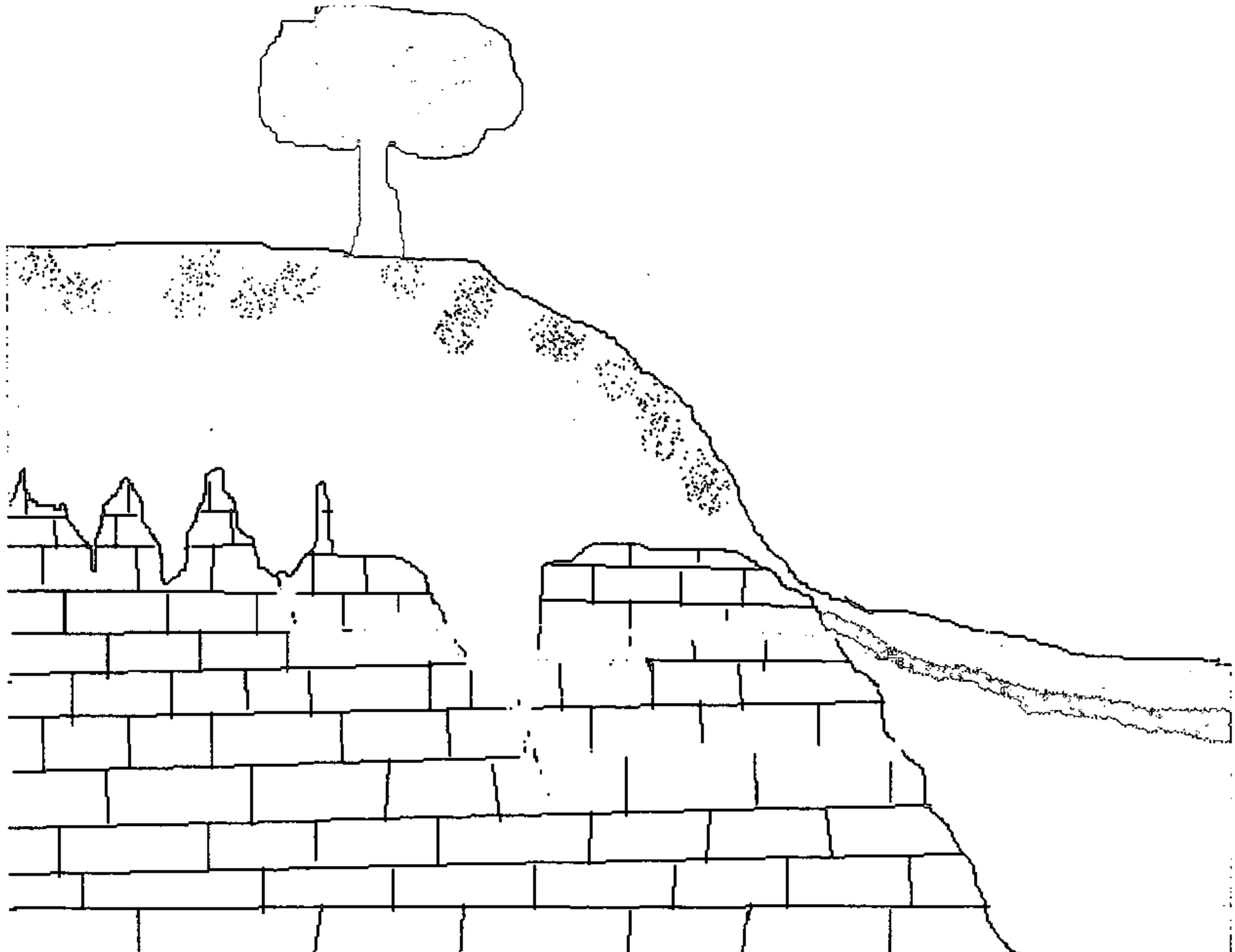
MEW PROPERTY

NOTES

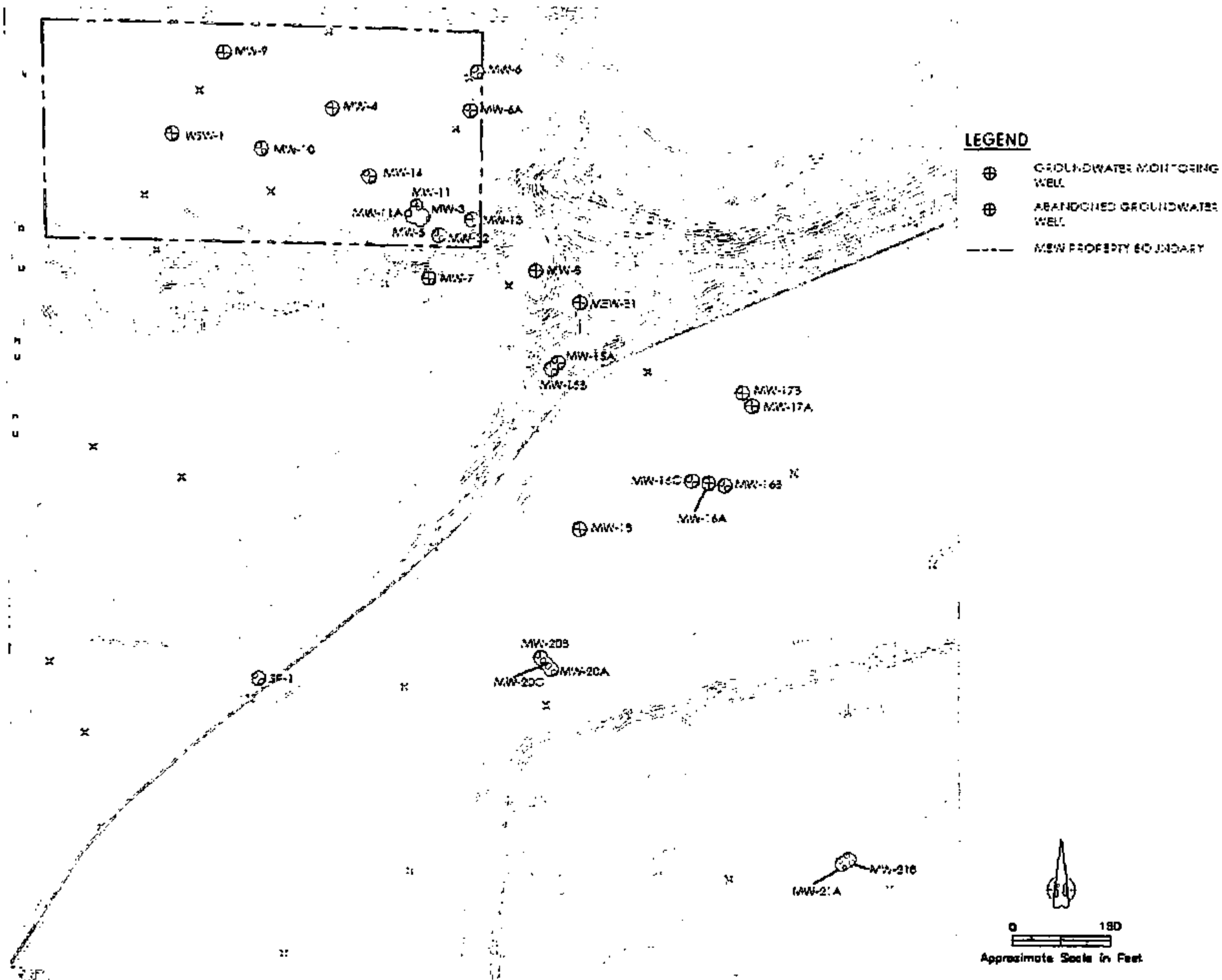
1. View from south.
2. Vertical exaggeration approximately [illegible] times.

NOT TO SCALE

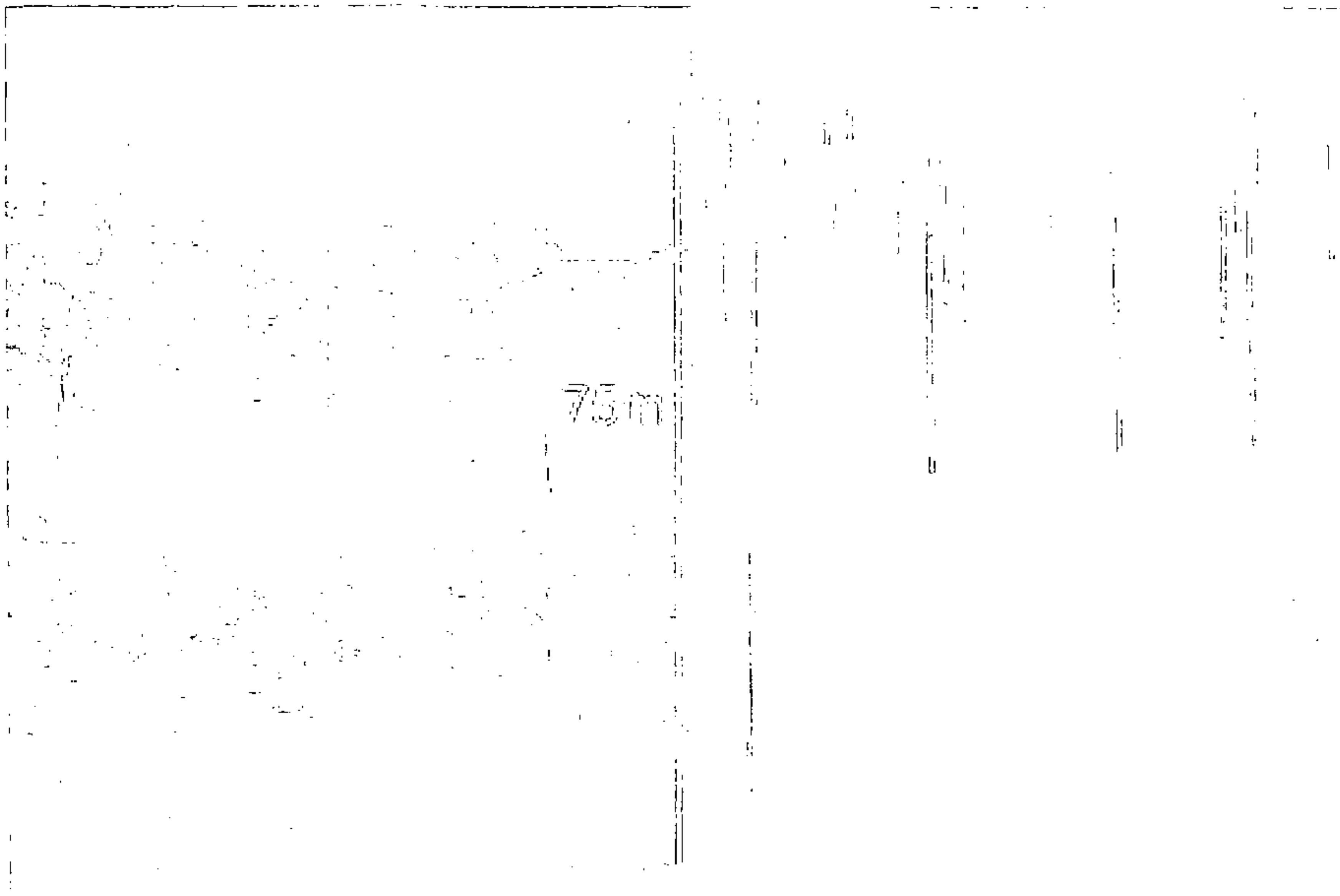
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Topographical Relief of Area	Figure 11



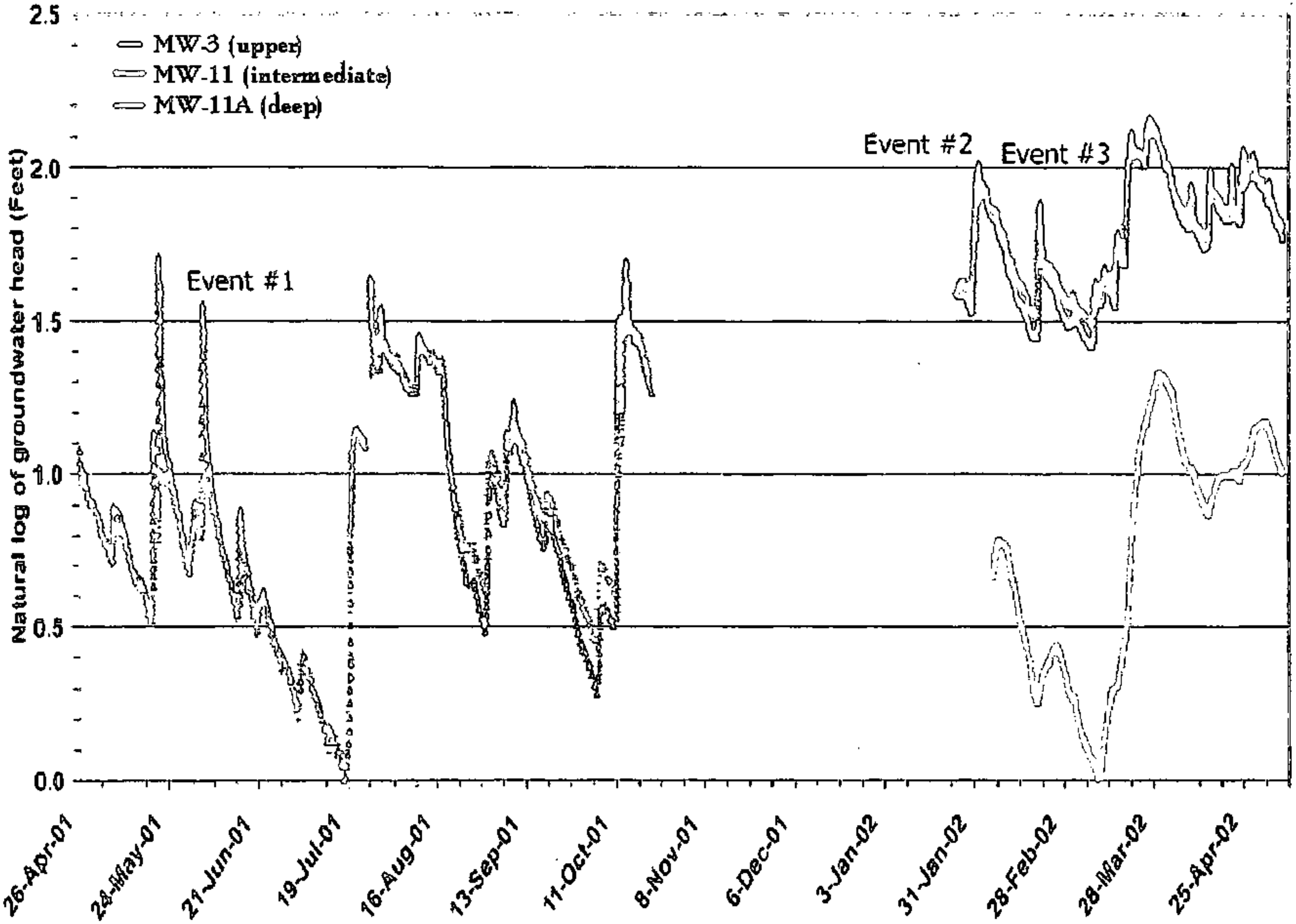
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Karst Bedrock Surface**	**Figure 12**



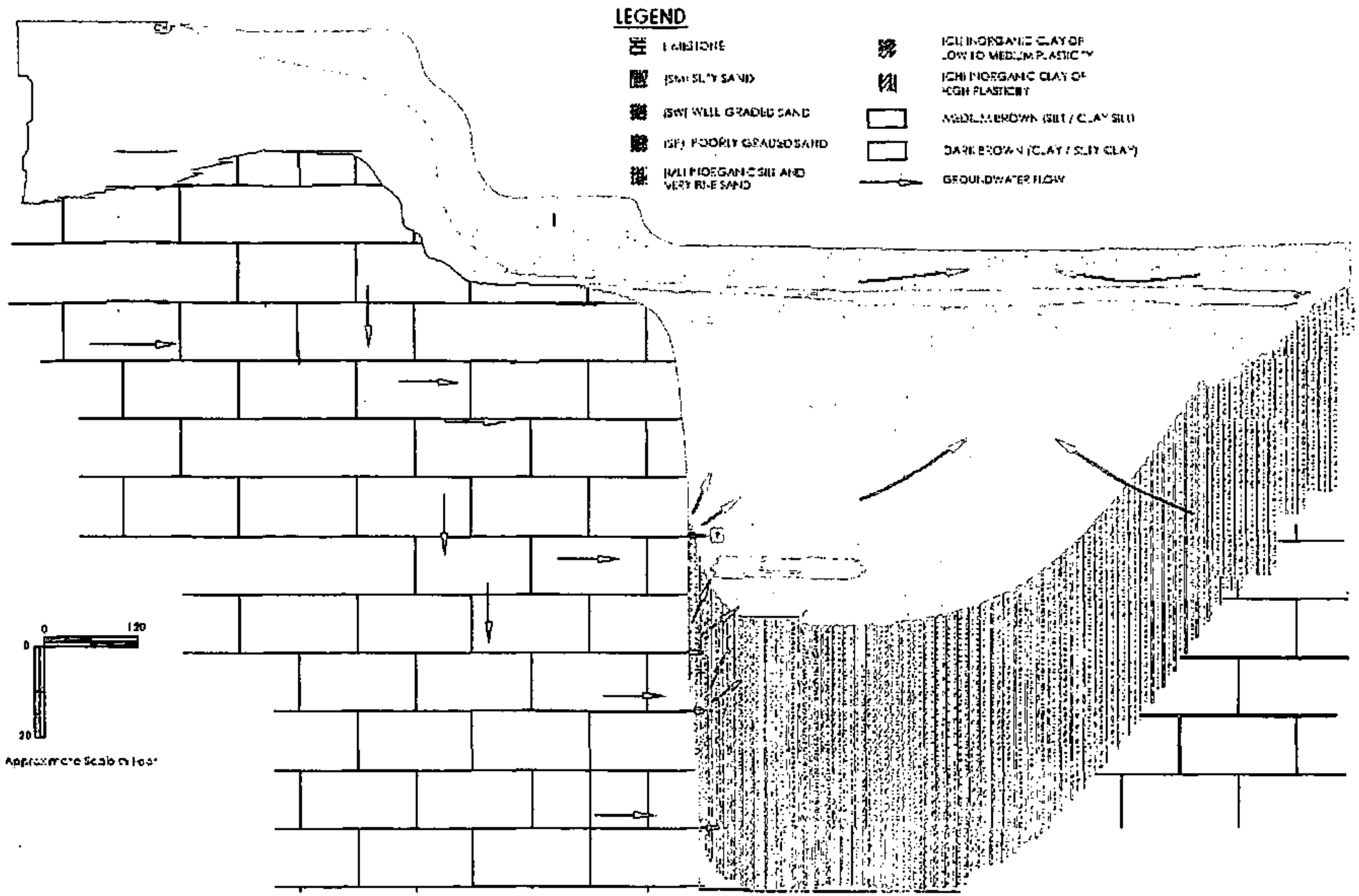
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Location of Monitoring Wells**	**Figure 13**



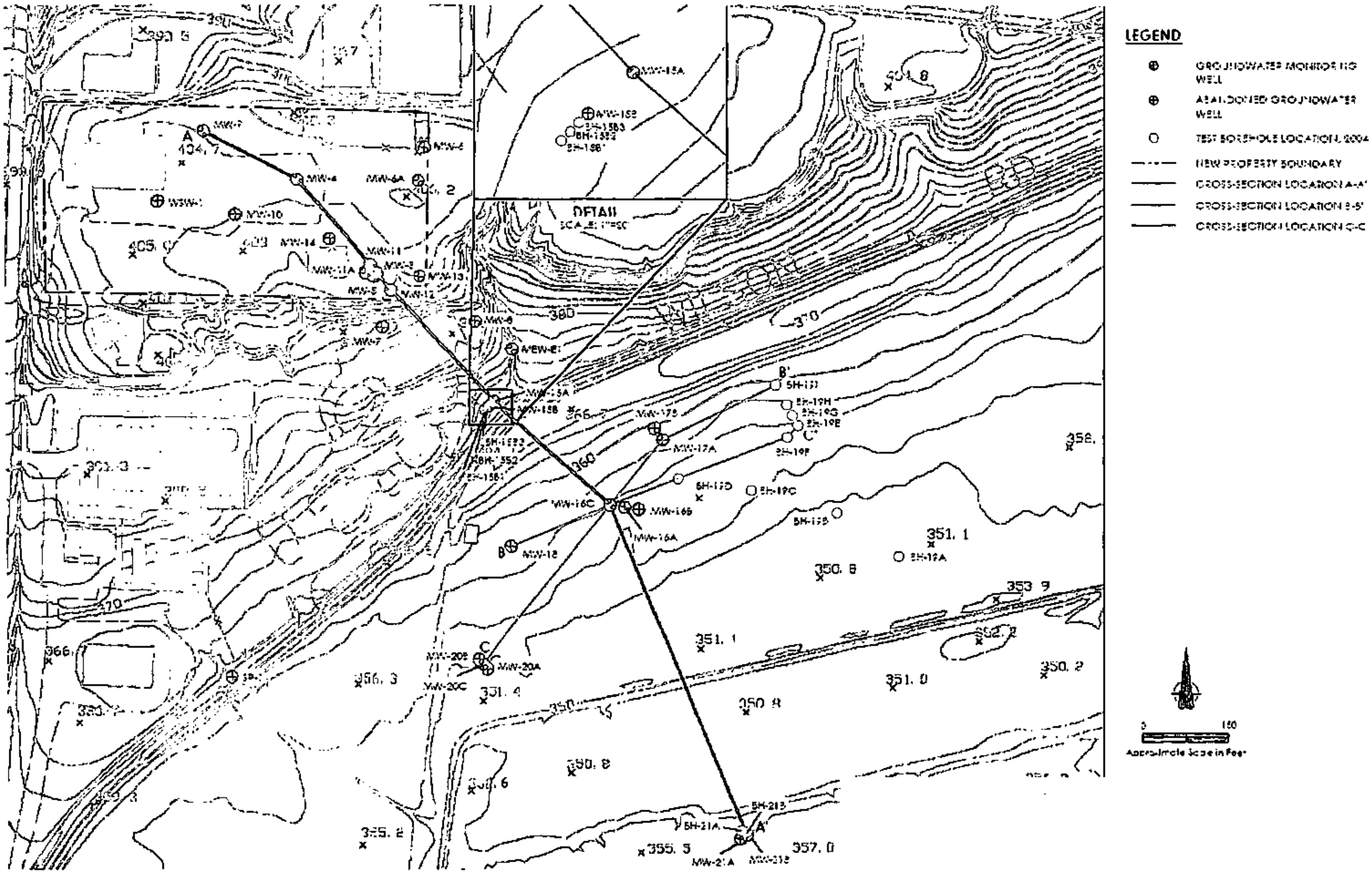
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Measured and Modeled Vertical Fractures	Figure 14



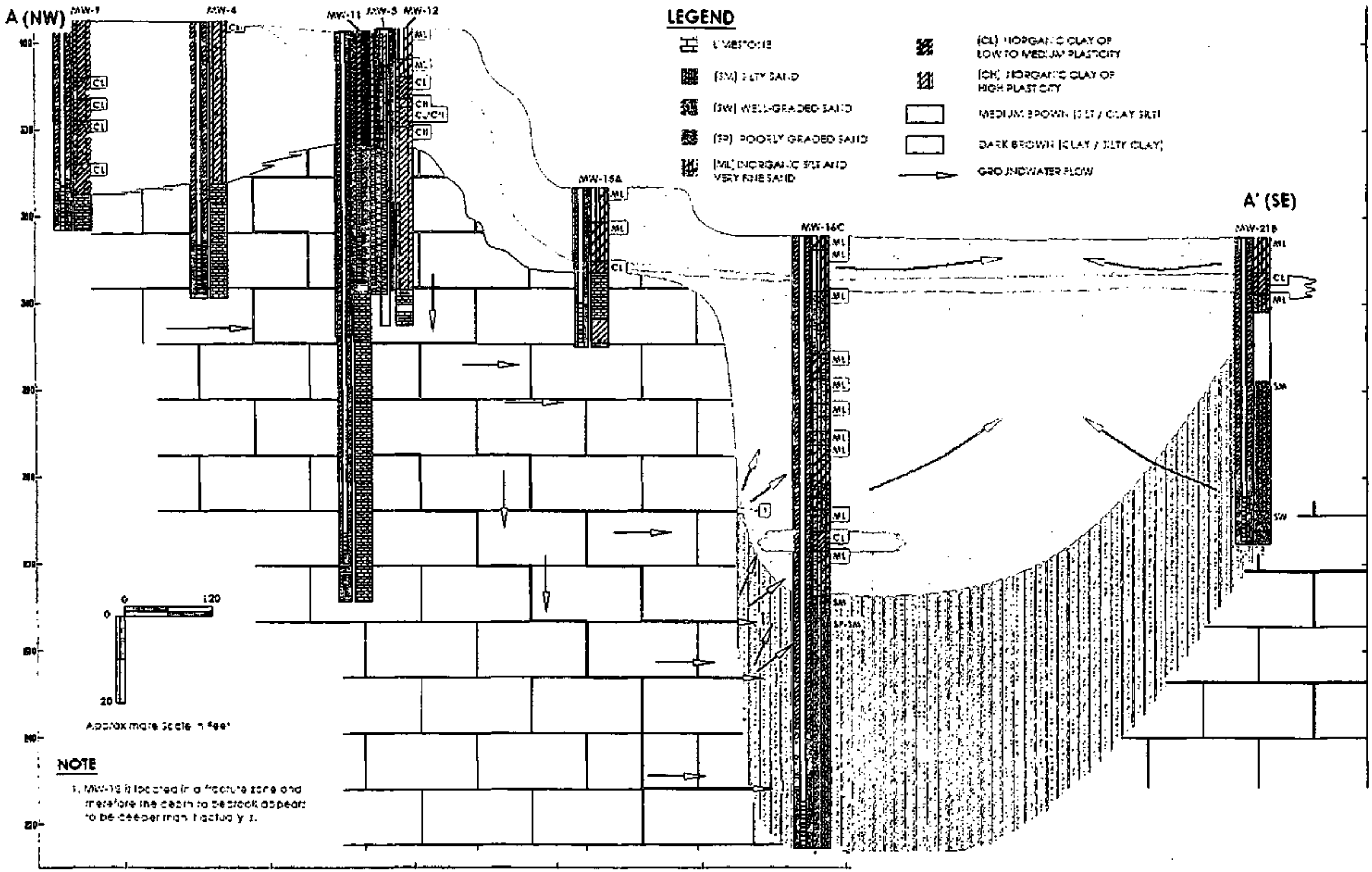
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Hydrographs for Upper, Intermediate and Deep Bedrock	Figure 15



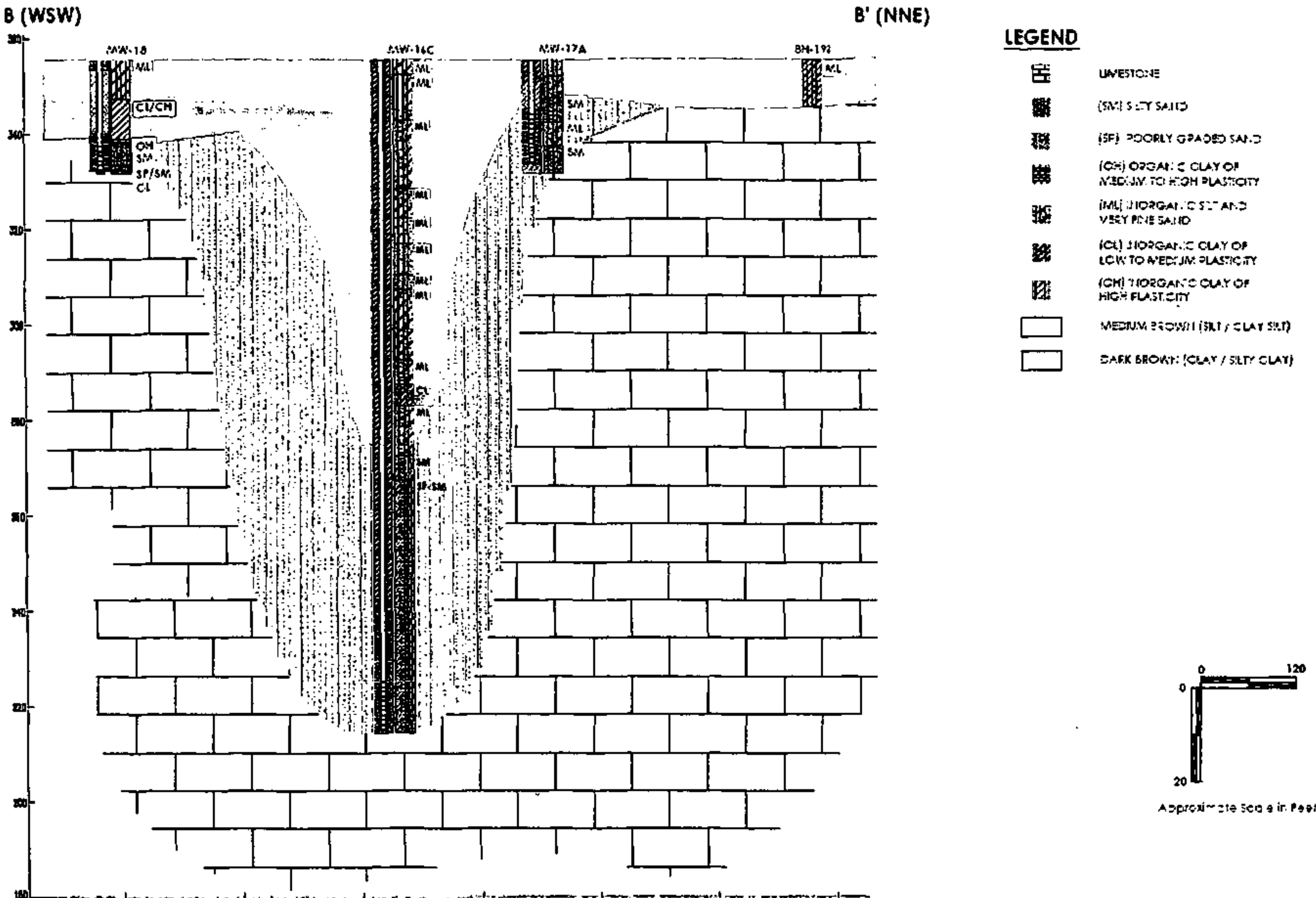
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Potential Groundwater Flow Paths**	**Figure 16**



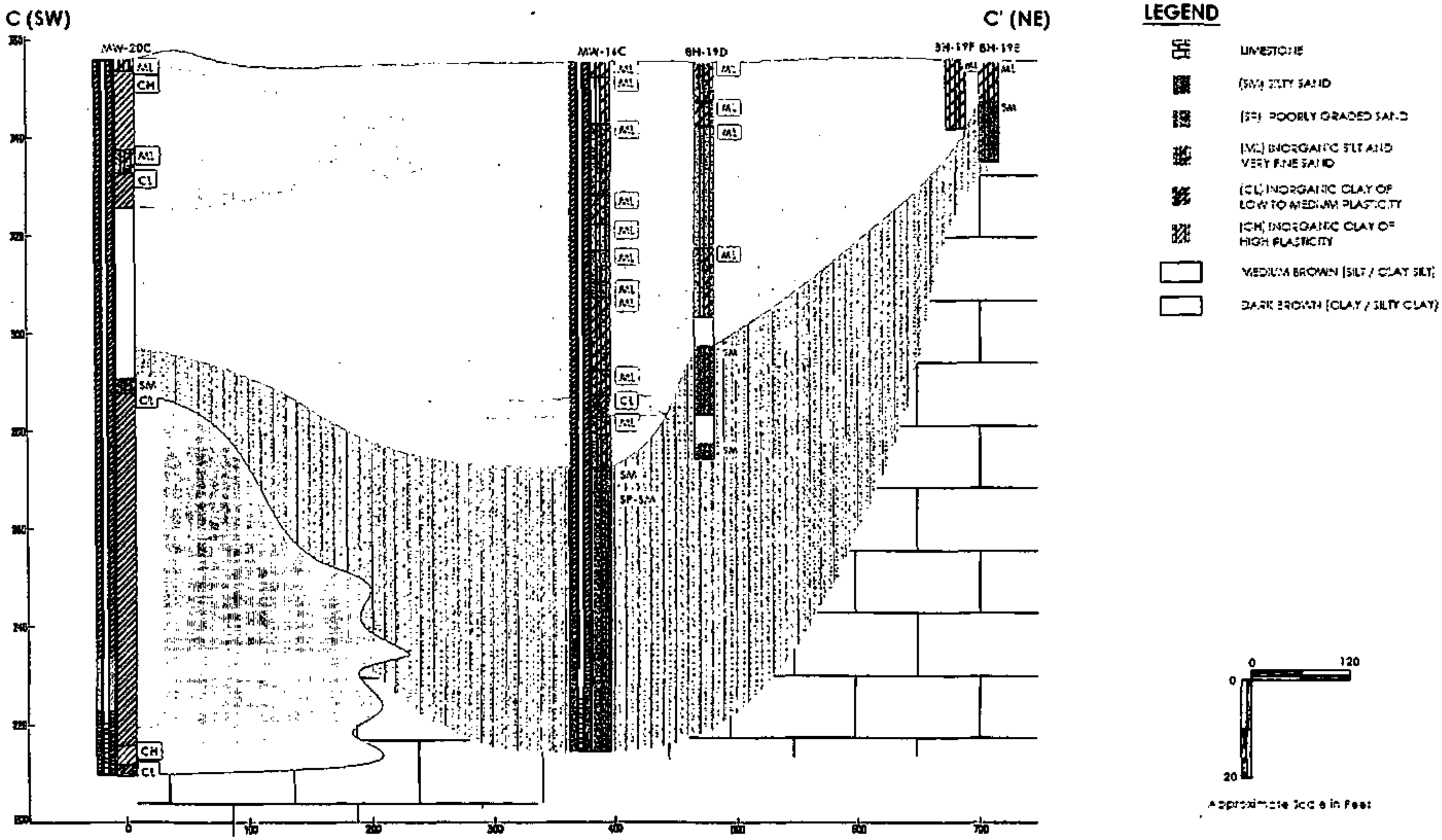
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Cross-Section Locations**	**Figure 17**



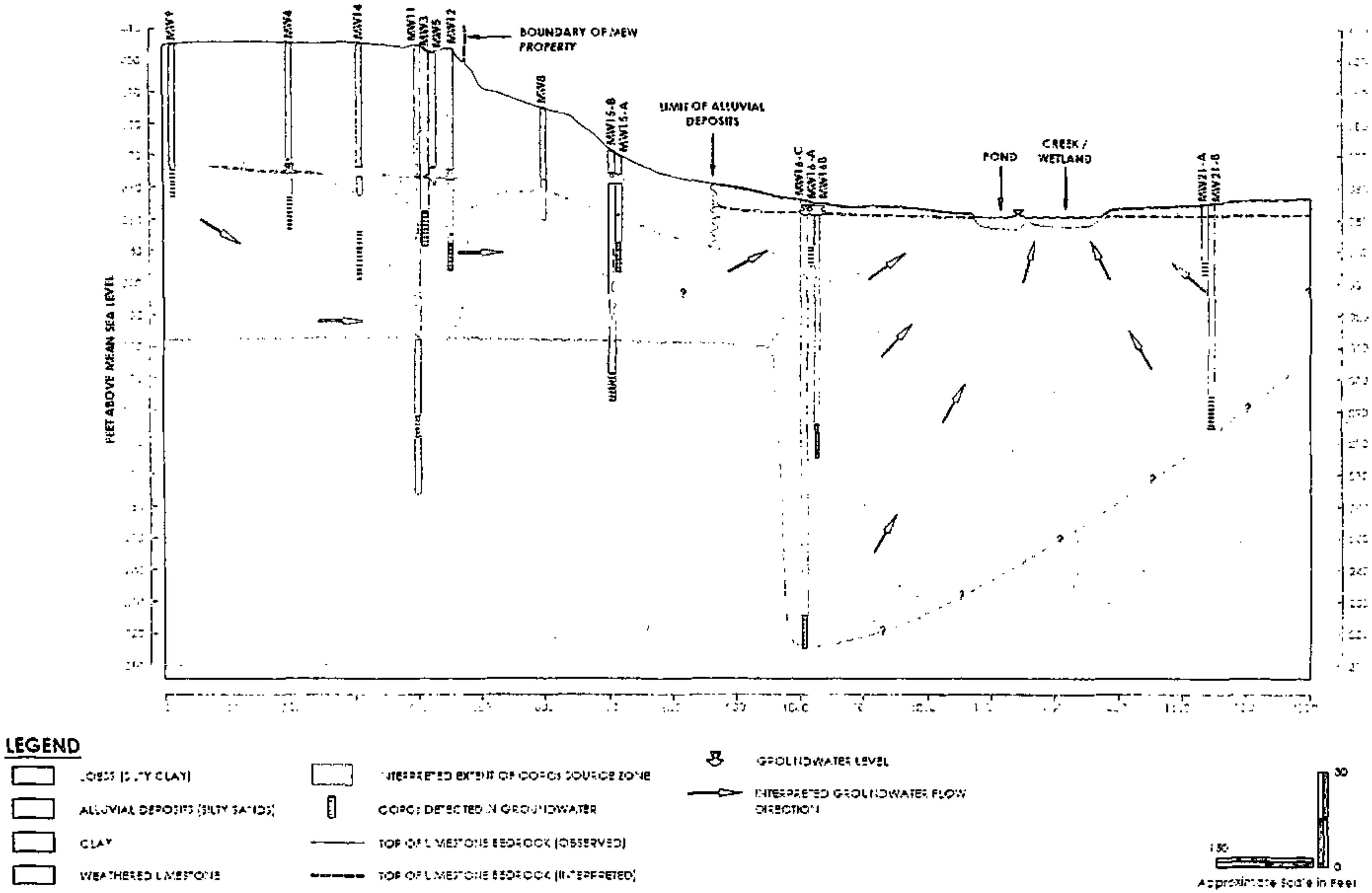
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Cross-Section A-A'	Figure 18



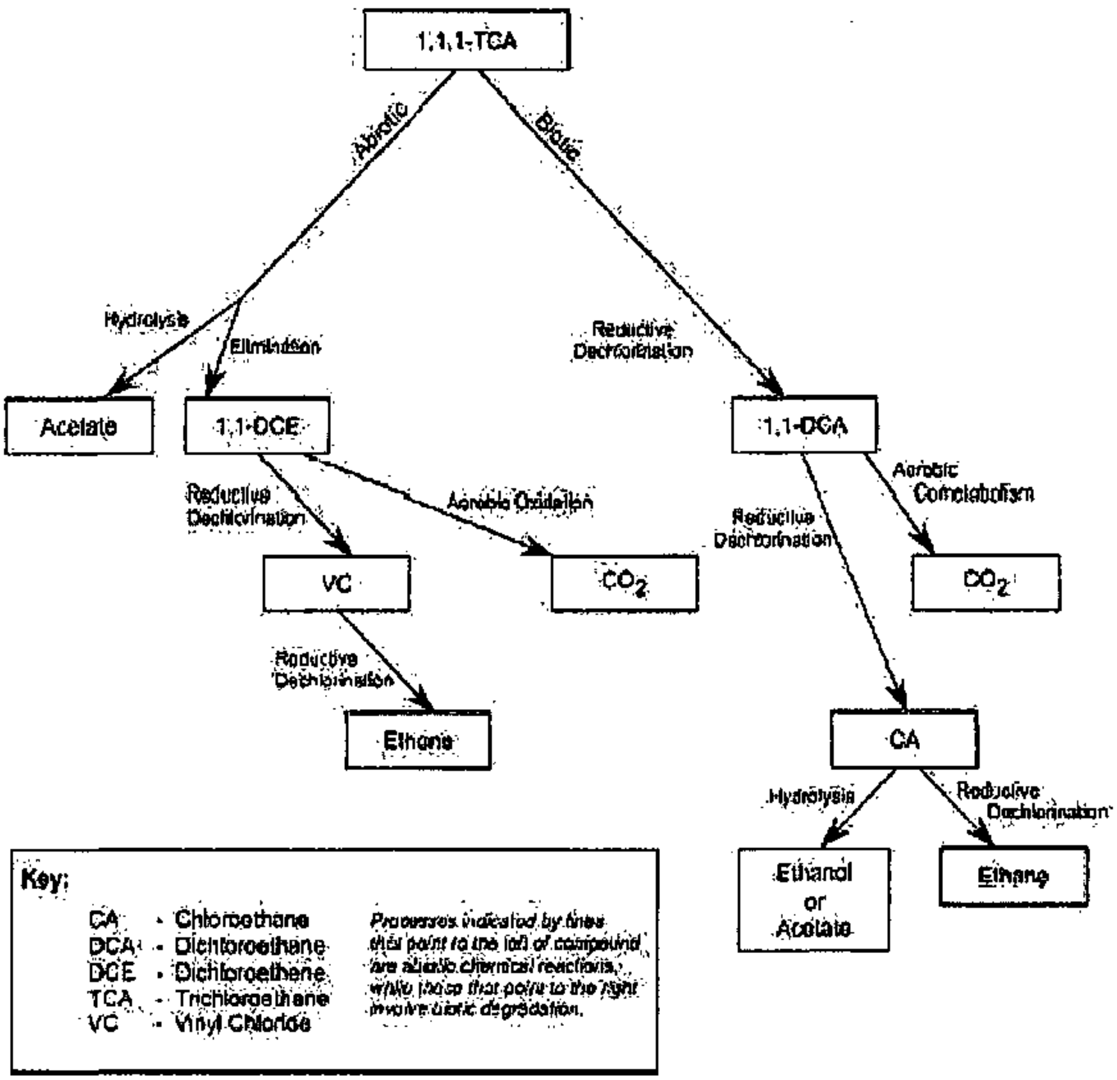
from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Cross-Section B-B'	Figure 19



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Cross-Section C-C'	Figure 20

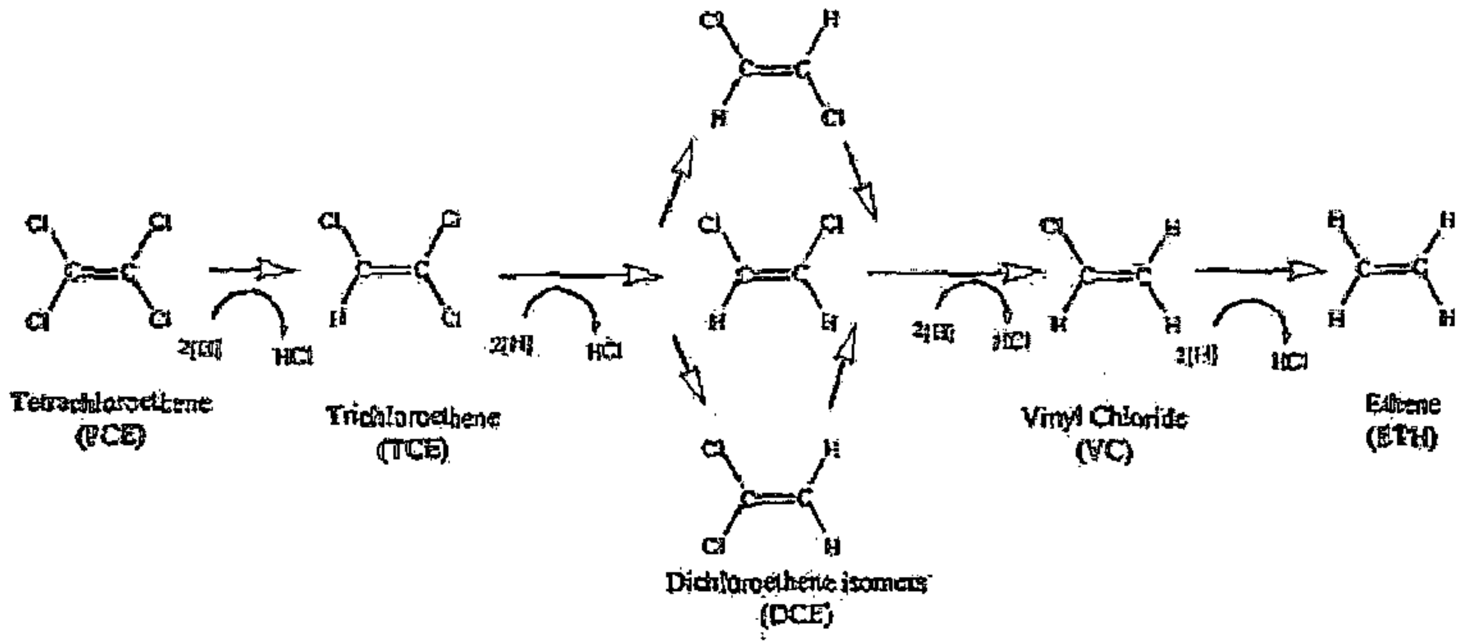


from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Schematic of Subsurface Conditions**	**Figure 21**



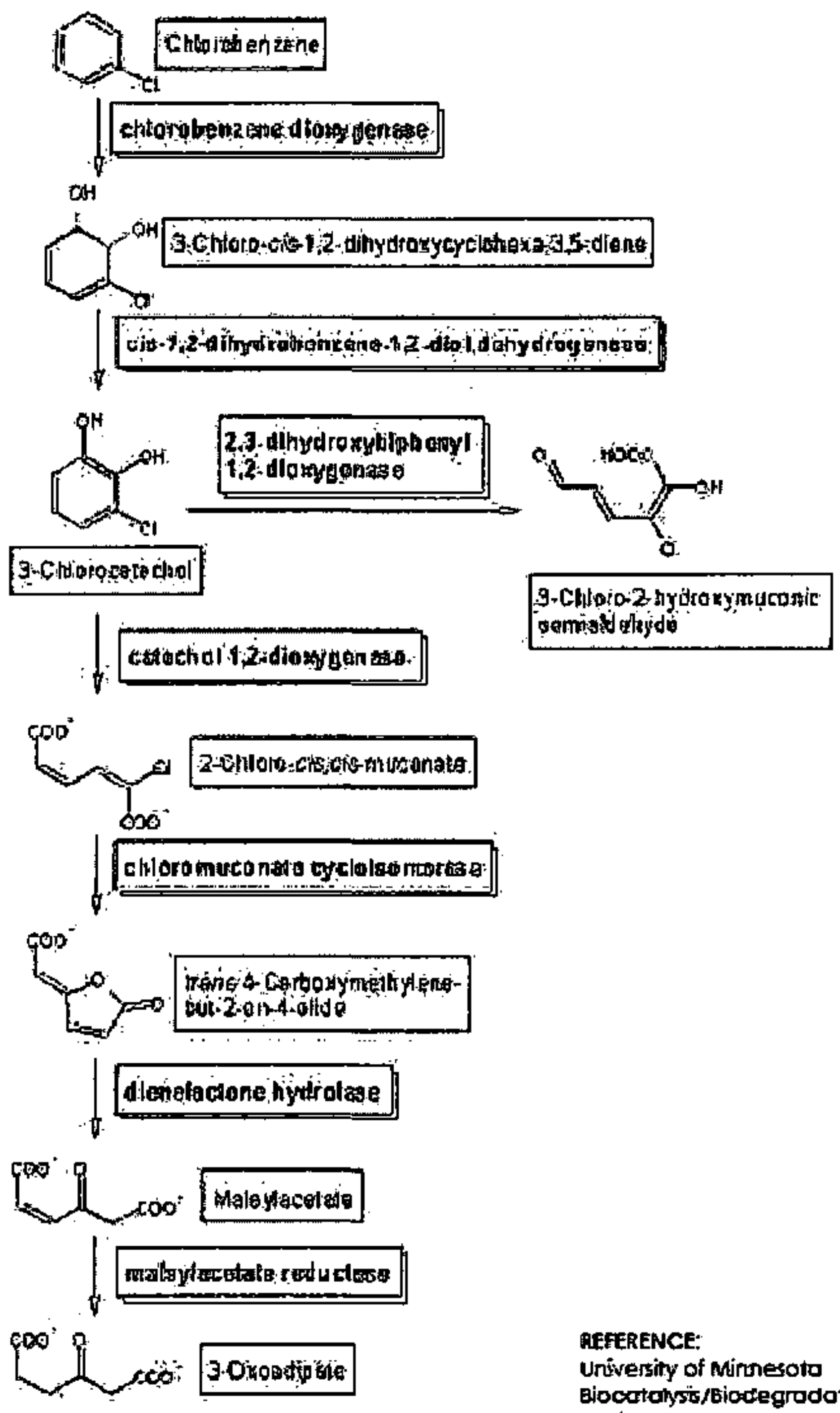
REFERENCE:
U.S. EPA Technical Protocol for evaluating natural attenuation of chlorinated solvents in groundwater, 1998 [EPA/600/R-98/128].

from KOMEX, Remedial Investigation Report, 2005	**MISSOURI ELECTRIC WORKS SITE** **1,1,1-Trichloroethane Degradation Pathway**	**Figure 22**



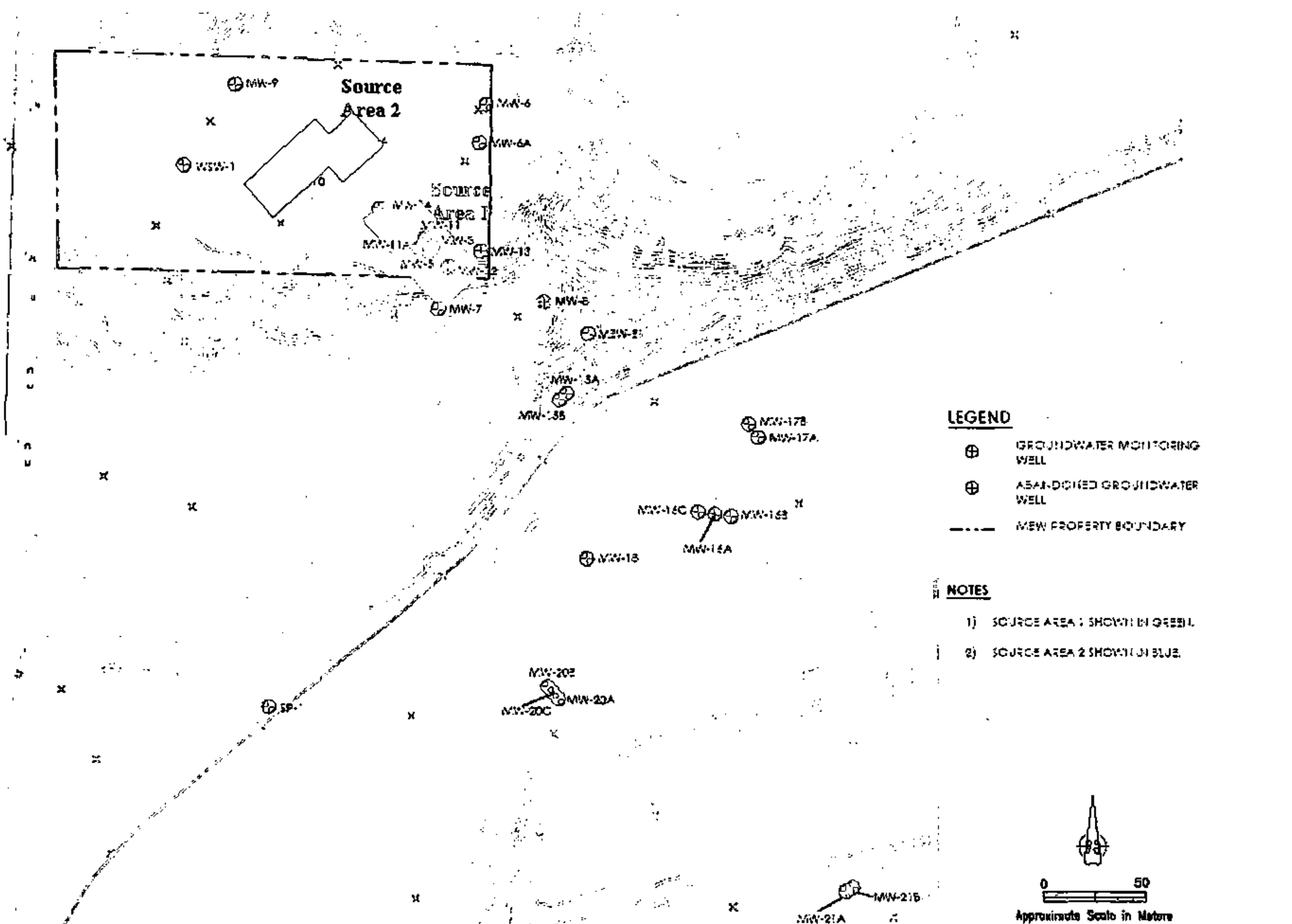
REFERENCE:
Max M. Haggblom & Ingeborg D. Bossert
Dehalogenation: Microbial processes and environmental applications, 2003 (pp 386).

from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **PCE Degradation**	**Figure 23**

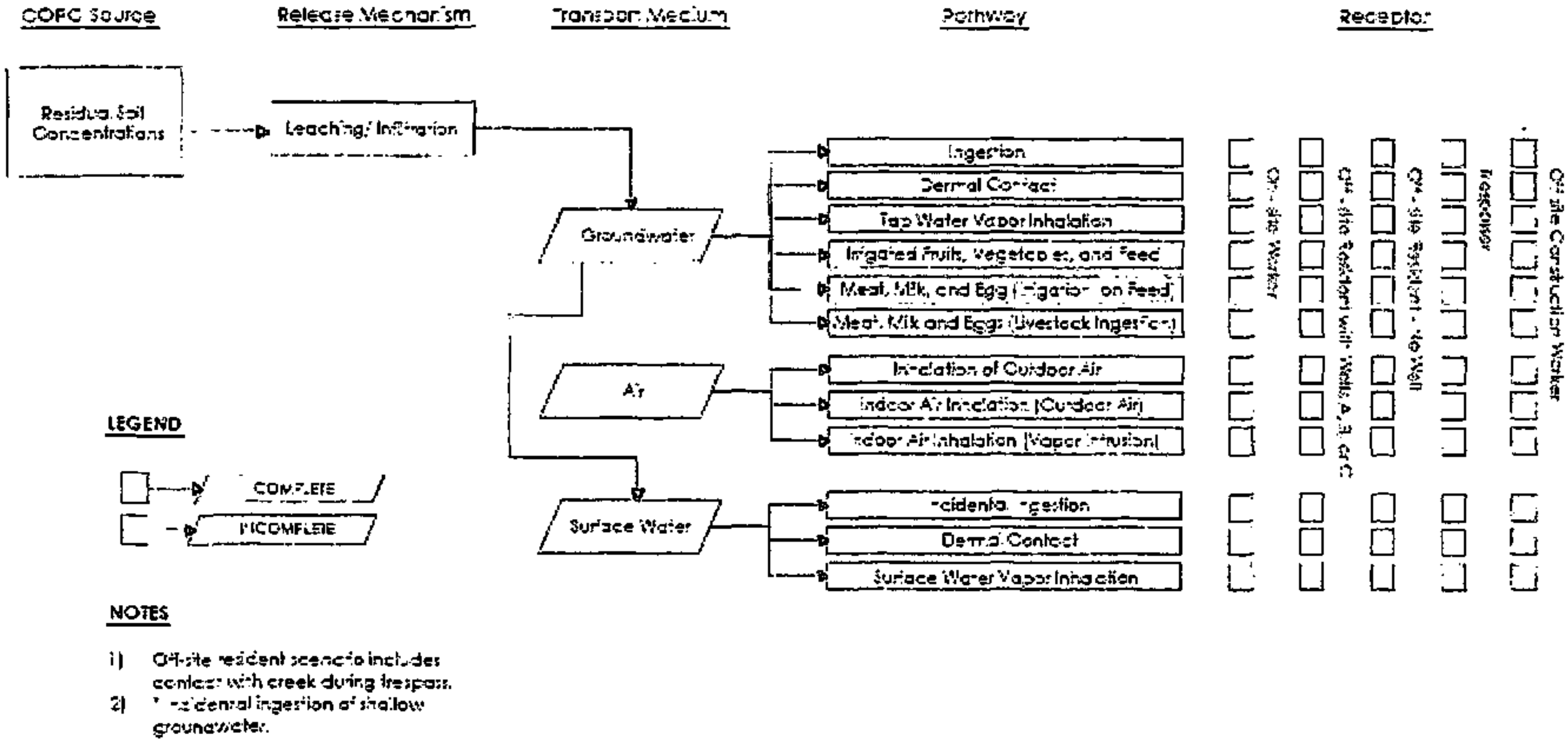


REFERENCE:
University of Minnesota
Biocatalysis/Biodegradation Database,
April 6, 2005, Http://umbbd/ahc/umn.edu

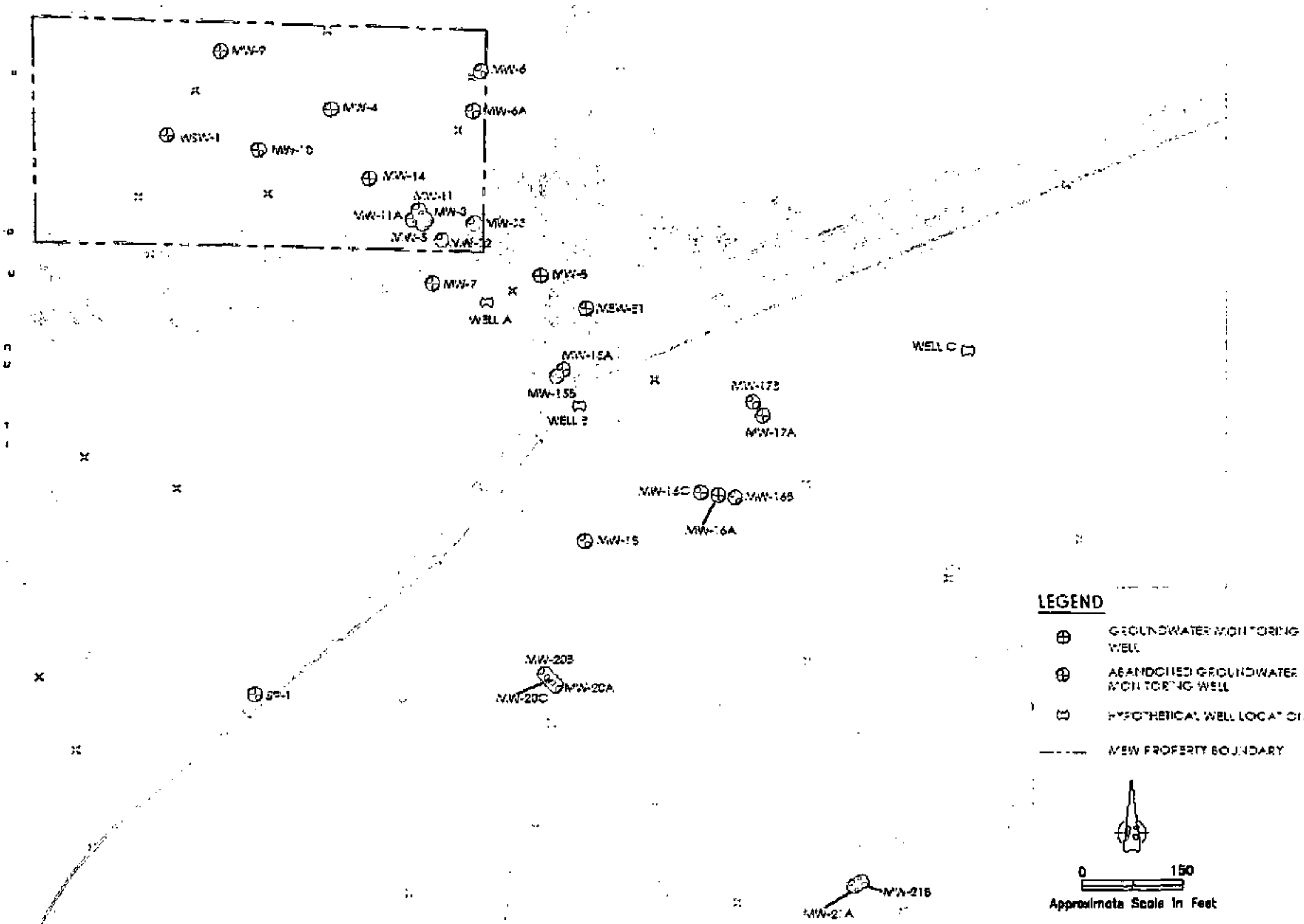
from KOMEX, Remedial Investigation Report, 2005	**MISSOURI ELECTRIC WORKS SITE** **Chlorobenzene Degradation Pathway**	**Figure 24**



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Location of Groundwater Contaminant Source Areas	Figure 25



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE **Conceptual Exposure Pathways**	**Figure 26**



from KOMEX, Remedial Investigation Report, 2005	MISSOURI ELECTRIC WORKS SITE Location of Hypothetical Wells	Figure 27

APPENDIX A

Groundwater Monitoring Data

1.1.1- Trichloroethane (1,1,1-TCA) Groundwater Concentrations

MCL: 200 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0						
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0						
10	**8**	**5.6**	**6.6**	**6.4**	**6**	<5.0	**5.3**	**4J**	**5**	<5.0	<5.0	**3J**	<5.0	<5.0	**1.8J**	<5.0
11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0	--	--	**2J**	<5.0	<5.0	<5.0	<5.0	<5.0		**4.8J**	**2.3J**	**1.9J**
12	These wells were installed during late November – early December 2002. They were first sampled on December 11, 2002. 1,1,1–TCA concentrations were less than 5.0 ppb.							<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,1,1-TCA concentrations were <5.0 ppb.										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16C											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,1,1-TCA concentrations were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Trichlorethene (TCE) Groundwater Concentrations

MCL: 5 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	<5.0	<5.0	<5.0	<5.0	5	3J	1.4	4J	3J	3J	5.2	5.1	2.9J	3.1J	3.2J	5.6
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
10	7.2	7.9	5.9	9.3	13	12	12	10	8.7	5.6	4J	4J	3.3J	3.9J	2.6J	6.1
11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	3.2	2J	<5.0	2J	5.6	5.4	3.4J	8.9	8.2	9.3
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2J	--	--	5J	3J	4J	<5.0	4.8J	2.3J	1.9J
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. TCE concentrations were less than 5.0 ppb.							<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.4J
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. TCE concentrations were <5.0 ppb with the exception of MW-16B and MW-16C which had concentrations of 9.2 ppb and 9.1 ppb respectively.										<5.0	<5.0	<5.0	<5.0	2.0J	1.2J
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											9.5	7.4	8.8	9.2	8.4	11
16C											9.9	9.2	8.6	7.7	7.4	8.2
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. TCE concentrations were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Table A-3

Tetrachloroethene (PCE) Groundwater Concentrations

MCL: 5 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	<5.0	<5.0	<5.0	<5.0	3J	8.6	2.4	2J	<5.0	4J	5J	<5.0	<5.0	4.2J	2.6J	1.4J
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1J			<5.0			
10	<5.0	<5.0	<5.0	<5.0	3J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	--	--	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.8J
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. PCE concentrations were less than 5.0 ppb.							<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	4.7J
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15A	These wells were installed during late August to early September 2003. They were *first sampled* September 15 or 16, 2003. PCE concentrations were <5.0 ppb.										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16C											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. PCE concentrations were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

1,1-Dichloroethane (1,1-DCA) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	19	8.8	<5.0	13	15	24	17	7.5	18	9.8	15	22	16	16	14	18
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2J	<5.0			<5.0			
10	16	<5.0	22	17	31	29	29	22	20	22	18	21	15	12	15	17
11	<5.0	<5.0	<5.0	<5.0	<5.0	4J	2.8	2J	<5.0	2J	3J	3J	2.8J	3.2J	2.9J	3.3J
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0	<5.0		2J			8.7	5.7	5J	5.4	3.8J	4.0J	10
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,1-DCA concentrations were less than 5.0 ppb.							<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								3J	<5.0	3J	3J	4J	<5.0	3.2J	6.4	4.4J
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,1-DCA concentrations were <5.0 ppb with the exceptions of MW-16B and MW-16C which had concentrations of 2J ppb and 6.5 ppb, respectively.										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	2J	1.6J	1.7J	1.8J	1.8J
16C											5J	5J	5.7	4.5J	6.0	5.1
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,1-DCA concentrations were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Table A-5

1,1-Dichloroethene (1,1-DCE) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	7.7	<5.0	<5.0	**6.4**	9.9	**6.1**	**2.2**	7	<5.0	**5.2**	**5.1**	**9.8**	**6.9**	**5.7**	**6.9**	**6.4**
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
10	7	<5.0	**6.8**	**7.8**	**10**	**8.9**	**9**	7.6	**5J**	**4J**	**4J**	**4J**	**3.6J**	**2.5J**	**3.8J**	**3.5J**
11	<5.0	<5.0	<5.0	<5.0	**4J**	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0			**2J**			**4J**	**4J**	**3J**	**3.7J**	**2.6J**	**3.6**	**6.4**
12	**These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,1-DCE concentrations were less than 5.0 ppb.**							<5.0	<5.0	<5.0	2J	<5.0	<5.0	<5.0	<5.0	<5.0
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15A	**These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,1-DCE concentrations were <5.0 ppb with the exception of MW-16B which had "J" coded data (1J).**										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	**1J**	<5.0	<5.0	**1.6J**	**1.1J**
16C											<5.0	**2J**	<5.0	<5.0	**1.8J**	**1.5J**
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	**These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,1-DCE concentrations were <5.0 ppb.**												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Table A-6

1,2-Dichloroethene (1,2-DCE) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4	<5.0	<5.0	<5.0	<5.0	**4J**	**2J**	<5.0	**3J**	<5.0	**2J**	**2J**	**4J**	**2.4J**	**1.8J**	**1.6J**	**3.0J**
5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11	<5.0	<5.0	<5.0	<5.0	**2J**	**8**	**6.4**	**3J**	**<5.0**	**4J**	**9.8**	**7.7**	**7.7**	**12**	**8.5**	**9.1**
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0			<5.0			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
12	**These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,2–DCE concentrations were less than 5.0 ppb.**							<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**2.0J**	**1.8J**	**1.9J**
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15A	**These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,2-DCE concentrations were <5.0 ppb with the exceptions of MW-16B and MW-16C which had concentrations of 3J and 12 ppb respectively.**										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											**3J**	**2J**	**2.2J**	**2.8J**	**2.6J**	**3.2J**
16C											**12**	**11**	**10**	**9.2**	**10**	**10**
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	**These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,2-DCE concentrations were <5.0 ppb.**												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Benzene Groundwater Concentrations

MCL: 5 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	5.3	5.6	16	14	17	11	9	9.6	7.3	8	11	8.8	9.0	6.1	4.7J	11
4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
5	<5.0	<5.0	<5.0	<5.0	<5.0	3J	2J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0			<5.0			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. Benzene concentrations were less than 5.0 ppb with the exception of MW-12 which had a concentration of 26 ppb..							30	19	51	42	54	53	62	83	79
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
14								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. Benzene concentrations were <5.0 ppb.										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	<5.0	<5.0	<5.0	1.7J	<5.0
16C											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	0.6J
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. Concentrations of Benzene were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Table A-8

Chlorobenzene Groundwater Concentrations

MCL: 20 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	510	320	1,400	1,600	1,200	590	630	800	630	420	250	690	770	520	390	600
4	30	6.3	15	21	42	<5.0	<5.0	17	14	5J	4J	39	29	12	23	53
5	19	<5.0	16	29	45	120	130	44	7.9	38	32	20	37	48	14	12
6A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
7	<5.0	<5.0	<5.0	5.6	9.8	<5.0	<5.0	<5.0	<5.0	2J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			<5.0			
10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
11	6.2	8.2	7.7	<5.0	18	39	1.9	4J	<5.0	5J	3J	<5.0	10	1.5J	3.0J	7.9
11A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
WSW	<5.0	<5.0	<5.0	<5.0			2J			<5.0	<5.0	3J	1.8J	<5.0	<5.0	<5.0
12	These wells were installed during late late fall 2002. They were first sampled on December 11, 2002. Chlorobenzene concentrations were: 3,000 ppb inMW-12; < 5.0 ppb in MW-13; and 7.4 ppb in MW-14.							2,000	2,000	1,800	2,000	2,100	1,500	2,700	3,200	2,200
13								<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.1J	4.4J
14								2J	8.9	5J	5J	6	4.7J	7.9	15	16
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. Chlorobenzene concentrations were <5.0 ppb.										<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
15B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
16C											<5.0	<5.0	<5.0	<5.0	2.9J	0.6J
17A											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
17B											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
18											<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. Chlorobenzene concentrations were <5.0 ppb.												<5.0	<5.0	<5.0	<5.0
20B													<5.0	<5.0	<5.0	<5.0
20C													<5.0	<5.0	<5.0	<5.0
21A													<5.0	<5.0	<5.0	<5.0
21B													<5.0	<5.0	<5.0	<5.0

Table A-9

1,2,4-Trichlorobenzene (1,2,4-TCB) Groundwater Concentrations

MCL: 70 ppb

Well No.	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
	Concentration in ppb															
3	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4	41	<10	18	16	30	30	<10	20	22	8J	6J	45	41	11	21	59
5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
6A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
7	24	<10	<10	<10	16	28	8J	15	51	62	16	13	21	36	25	42
9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
10	31	31	28	18	10	13	12	9J	7J	4J	4J	3J	<10	<10	<10	<10
11	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
11A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
WSW	<10	<10	<10	<10			<10			<10	<10	<10	<10	<10	<10	<10
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,2,4–TCB concentrations were less than 10 ppb with the exception of MW-12 which had a concentration of 30 ppb.							26	<10	16	16	11	13	14	14	9.8J
13								<10	<10	<10	<10	<10	<10	<10	<10	<10
14								<10	<10	<10	2J	2J	<10	2.5J	5.5J	7.1J
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,2,4-TCB concentrations were <10 ppb.										<10	<10	<10	<10	<10	<10
15B											<10	<10	<10	<10	<10	<10
16A											<10	<10	<10	<10	<10	<10
16B											<10	<10	<10	<10	<10	<10
16C											2J	<10	<10	<10	<10	<10
17A											<10	<10	<10	<10	<10	<10
17B											<10	<10	<10	<10	<10	<10
18											<10	<10	<10	<10	<10	<10
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,2,4-TCB concentrations were <10 ppb.												<10	<10	<10	<10
20B													<10	<10	<10	<10
20C													<10	<10	<10	<10
21A													<10	<10	<10	<10
21B													<10	<10	<10	<10

Table A-10

1,2-Dichlorobenzene (1,2-DCB) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<10	<10	<10	<10	<10	<10	2J	2J	<10	2J	2J	2J	1.5J	2.0J	<10	<10
4	<10	<10	<10	3J	<10	5U	4J	2J	<10	<10	5J	5J	4.8J	15J	2.4J	7.2J
5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
6A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
7	<10	<10	<10	<10	<10	<10	<10	<10	<10	2J	<10	<10	<10	<10	<10	<10
9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
11	<10	<10	<10	<10	<10	<10	5U	<10	<10	<10	<10	<10	<10	<10	<10	<10
11A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
WSW	<10	<10	<10	<10			<10			<10	<10	<10	<10	<10	<10	<10
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,2–DCB concentrations were less than 10 ppb with the exception of MW-12 which had a concentration of 33 ppb.							28	9J	19	17	15	16	20	15	14
13								<10	<10	<10	<10	<10	<10	<10	<10	<10
14								<10	<10	<10	2J	2J	<10	2.4J	4.0J	5.4J
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,2-DCB concentrations were <10 ppb.										<10	<10	<10	<10	<10	<10
15B											<10	<10	<10	<10	<10	<10
16A											<10	<10	<10	<10	<10	<10
16B											<10	<10	<10	<10	<10	<10
16C											<10	<10	<10	<10	<10	<10
17A											<10	<10	<10	<10	<10	<10
17B											<10	<10	<10	<10	<10	<10
18											<10	<10	<10	<10	<10	<10
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. Concentrations of 1,2-DCB were <10 ppb.												<10	<10	<10	<10
20B													<10	<10	<10	<10
20C													<10	<10	<10	<10
21A													<10	<10	<10	<10
21B													<10	<10	<10	<10

1,3-Dichlorobenzene (1,3-DCB) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<10	<10	<10	<10	6J	6J	8J	9J	<10	9J	9J	6J	5.7J	6.4J	4.6J	4.2J
4	13	<10	<10	<10	8J	<10	5U	9J	7J	10	7J	16	16	9.4J	8.7J	24
5	<10	<10	<10	<10	<10	<10	<10	1J	8J	<10	<10	<10	<10	<10	<10	<10
6A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
7	<10	<10	<10	<10	<10	<10	<10	2J	4J	4J	2J	<10	<10	<10	<10	<10
9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
11	<10	<10	<10	<10	<10	<10	5U	<10	<10	<10	<10	<10	<10	<10	<10	<10
11A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
WSW	<10	<10	<10	<10			<10			<10	<10	<10	<10	<10	<10	<10
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,3-DCB concentrations were less than 10 ppb with the exception of MW-12 which had a concentration of 98 ppb.							100	37	71	67	51	54	68	55	52
13								<10	<10	<10	<10	<10	<10	<10	<10	<10
14								<10	<10	<10	2J	2J	2.1J	3.2J	4.8J	7.5J
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,3-DCB concentrations were <10 ppb.										<10	<10	<10	<10	<10	<10
15B											<10	<10	<10	<10	<10	<10
16A											<10	<10	<10	<10	<10	<10
16B											<10	<10	<10	<10	<10	<10
16C											3J	3J	2.6J	2.5J	2.5J	2.5J
17A											<10	<10	<10	<10	<10	<10
17B											<10	<10	<10	<10	<10	<10
18											<10	<10	<10	<10	<10	<10
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. Concentrations of 1,3-DCB were <10 ppb.												<10	<10	<10	<10
20B													<10	<10	<10	<10
20C													<10	<10	<10	<10
21A													<10	<10	<10	<10
21B													<10	<10	<10	<10

1,4-Dichlorobenzene (1,4-DCB) Groundwater Concentrations

MCL: 750 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	25	16	17	12	17	18	20	22	<10	21	24	16	15	16	13	12
4	<10	<10	<10	13	4J	5U	9J	7J	5J	3J	21	21	23	8.2J	12	37
5	<10	<10	<10	<10	<10	5J	8J	7J	21	<10	5J	<10	<10	5.2J	2.4J	<10
6A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
7	<10	<10	<10	<10	<10	<10	<10	3J	4J	8J	2J	2J	<10	2.9J	2.6J	2.9J
9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10			<10			
10	<10	<10	<10	<10	<10	2J	<10	1J	<10	<10	<10	<10	<10	<10	<10	<10
11	<10	<10	<10	<10	<10	<10	5U	<10	<10	<10	<10	<10	1.6J	<10	<10	<10
11A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
WSW	<10	<10	<10	<10			<10			<10	<10	<10	<10	<10	<10	<10
12	These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. 1,4–DCB concentrations were less than 10 ppb with the exception of MW-12 which had a concentration of 120 ppb.							100	43	77	72	51	50	76	64	55
13								<10	<10	<10	<10	<10	<10	<10	<10	<10
14								<10	2J	4J	4J	4J	3.6J	5.6J	8.6J	13
15A	These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. 1,4-DCB concentrations were <10 ppb with the exception of MW-16C which had a concentration of 2J.										<10	<10	<10	<10	<10	<10
15B											<10	<10	<10	<10	<10	<10
16A											<10	<10	<10	<10	<10	<10
16B											<10	<10	<10	<10	<10	<10
16C											2J	<10	1.5J	1.4J	<10	1.6J
17A											<10	<10	<10	<10	<10	<10
17B											<10	<10	<10	<10	<10	<10
18											<10	<10	<10	<10	<10	<10
20A	These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. 1,4-DCB concentrations were <10 ppb.												<10	<10	<10	<10
20B													<10	<10	<10	<10
20C													<10	<10	<10	<10
21A													<10	<10	<10	<10
21B													<10	<10	<10	<10

Table A-13

Aroclor 1260 (unfiltered) Groundwater Concentrations

MCL: 0.5 ppb

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	**4.7**	**1.1**	<0.50	**1.2**	<0.50	**0.7**	**2.1**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	**0.4J**	<0.25	**0.6J**
4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
5	**85**	**11**	**5.4**	**13**	**12**	**110**	**36**	**14**	**5**	**11**	**28**	<0.50	**1.5**	**13**	**2.9**	**6.6**
6A	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50			<0.25			
7	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.3J**	<0.50	<0.25	<0.50	<0.25	<0.25
9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50			<0.25			
10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	<0.25	<0.25	<0.25
11	**14**	**3.5**	**0.9**	**1.2**	**2.6**	**0.69**	**0.59**	<0.50	<0.50	**1**	**0.4J**	<0.50	**0.2J**	**0.55**	<0.25	**0.7**
11A	**3**	<0.50	**1.8**	**1.4**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
WSW	<0.50	<0.50	<0.50	<0.50			<0.50			<0.50		<0.50	<0.25	<0.50	<0.25	<0.25
12	**These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. PCB (Aroclor 1260-unfiltered) concentrations were less than 0.50 ppb.**							<0.50	<0.50	<0.50	**8.3**	<0.50	<0.25	<0.25	<0.25	**0.45**
13								<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
14								<0.50	<0.50	<0.50	<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
15A	**These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. PCB (Aroclor 1260-unfiltered) concentrations were less than 0.50 ppb.**										<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
15B											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
16A											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
16B											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
16C											<0.50	<0.50	<0.25	<0.25	<0.25	<0.25
17A											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
17B											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
18											<0.50	<0.50	<0.25	<0.50	<0.25	<0.25
20A	**These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. PCB (Aroclor 1260-unfiltered) concentrations were less than 0.50 ppb.**												<0.25	<0.50	<0.25	<0.25
20B													<0.25	<0.50	<0.25	<0.25
20C													<0.25	<0.50	<0.25	<0.25
21A													<0.25	<0.50	<0.25	<0.25
21B													<0.25	<0.50	<0.25	<0.25

Table A-14

Aroclor 1260 (filtered) Groundwater Concentrations

MCL: *not established*

Well No.	Concentration in ppb															
	Apr-01	Jul-01	Oct-01	Jan-02	May-02	Aug-02	Oct-02	Feb-03	May-03	Aug-03	Oct-03	Feb-04	May-04	Aug-04	Nov-04	Feb-05
3	<0.20	<0.50	--	<0.50	--	**0.20U**	--	--	--	--	--	--	--	<0.50	--	<0.25
4	--	--	--	--	--	--	**0.20U**	--	--	--	--	--	--	--	--	--
5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	<0.50	<0.50	<0.25
6A	--	--	--	--	--	--	--	--	--	--			--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	**<0.50**	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--			--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	<0.50	<0.50	<0.50	<0.50	<0.50	--	**0.20U**	--	--	<0.50	<0.50	--	--	<0.50	--	<0.25
11A	<0.50	--	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--
WSW	--	--	--	--			--			--	--	--	--	--	--	--
12	**These wells were installed during late November - early December 2002. They were first sampled on December 11, 2002. Analysis for PCB (Aroclor 1260-filtered) was not performed at that time.**							--	--	<0.50	<0.50	--	--	<0.50		--
13								--	--	--	--	--	--	--	--	--
14								--	--	--	--	--	--	--	--	--
15A	**These wells were installed during late August to early September 2003. They were first sampled September 15 or 16, 2003. Analysis for PCB (Aroclor 1260-filtered) was not performed.**										--	--	--	--	--	--
15B											--	--	--	--	--	--
16A											--	--	--	--	--	--
16B											--	--	--	--	--	--
16C											--	--	--	--	--	--
17A											--	--	--	--	--	--
17B											--	--	--	--	--	--
18											--	--	--	--	--	--
20A	**These wells were installed during April 2004. They were first sampled April 19 or 20, 2004. Analysis for PCB (Aroclor 1260-filtered) was not performed.**												--	--	--	--
20B													--	--	--	--
20C													--	--	--	--
21A													--	--	--	--
21B													--	--	--	--

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Table A-15

Historical Groundwater Data

WELL	DATE	1,1,1-TCA	TCE	PCE	1,1-DCA	1,2-DCE	Benzene	Chlorobenzene	1,2,4-TCB	1,2-DCB	1,3-DCB	1,4-DCB	PCB
		CHEMICAL COMPOUND											
MW-3	Nov-89	--	--	--	16	52	--	86	--	--	--	--	<0.5
	Mar-90	--	4J	--	18	52	6J	240	--	--	--	--	--
	Jan-91	<5.0	<5.0		8	35	--	240	<0.1	58.5	9	6.5	--
MW-4	Mar-90	--	3J	12	6	--	--	--	--	--	--	--	--
	Jan-91	<5.0	<5.0	--	<5.0	<5.0	--	<5.0	<1.0	<1.0	<1.0	<1.0	--
MW-5	Nov-89	--	--	--	12	41	--	111	--	--	--	--	<5.0
	Mar-90	--	--	--	9	17	--	112	--	--	--	--	--
	Jan-91	<5.0	<5.0	--	5	9	--	29	<1.0	<1.0	<1.0	<1.0	--
MW-6A	Mar-90	--	--	--	--	--	--	--	--	--	--	--	--
	Jan-91	<5.0	<5.0	--	<5.0	<5.0	--	<5.0	1	<1.0	<1.0	<1.0	--
MW-7	Mar-90	--	--	--	--	--	--	--	--	--	--	--	--
	Jan-91	<5.0	<5.0		<5.0	<5.0		<5.0	65.5	<1.0	<1.0	<1.0	--
MW-8	Mar-90	--	--	--	--	--	--	--	--	--	--	--	--
	Jan-91	<5.0	<5.0		<5.0	<5.0		<5.0	<1.0	<1.0	<1.0	<1.0	--
MW-9	Mar-90	--	--	--	--	--	--	--	--	--	--	--	--
	Jan-91	<5.0	<5.0		<5.0	<5.0		<5.0	<1.0	<1.0	<1.0	<1.0	--
MW-10	Mar-90	--	17	--	3J	--	--	--	--	--	--	--	--
	Jan-91	6	17	--	--	<5.0	--	<5.0	<1.0	<1.0	<1.0	<1.0	--
MW-11	Jan-91	<5.0	8	--	<5.0	--	--	36	--	76	22	19	69

Notes:
TCA = trichloroethane
TCE = trichloroethene
PCE = tetrachloroethene
DCA = dichloroethane
TCB = trichlorobenzene
DCB = dichlorobenzene
-- not analyzed
Data reported as micrograms/liter (ug/l) or ppb

Potential Chemical Specific ARARs and TBCs

Authority	Requirement	Status	Synopsis of Requirement	Consideration in the FS
Federal Regulatory Requirements	Safe Drinking Water Act (SDWA) – Maximum Contaminant Levels (MCLs) (40 CFR §141.11 - 141.14). Revised MCLs (40 CFR §141.61 – 141.62) and non-zero Maximum Contaminant Level Goals (MCLGs) (40 CFR §141.50 – 141.51).	**Relevant and Appropriate**	MCLs have been promulgated for a number of common organic and inorganic contaminants to regulate the concentration of contaminants public drinking water supply systems. MCLs are applicable because Site groundwater is a potential drinking water supply.	MCLs are used to determine TCLs for groundwater.
	National Ambient Water Quality Criteria (NAWQC) (33 U.S.G. §1314(a) and 42 U.S.C. §9621(D)(2) AND Water Quality Standards (40 CFR §131.36(b) and 131.38)	**Relevant and Appropriate**	NAWQC and water quality standards are intended to protect human health and aquatic life from contamination in surface water.	Although the NAWQC are non-enforceable guidelines, they may be potentially relevant and appropriate for groundwater in the absence of promulgated MCLs or MCLGs. Water quality standards are relevant and appropriate in case the Site groundwater discharges to surface water or where the discharge alternative for treated groundwater is to surface water.
State Regulatory Requirements	Missouri Water Quality Standards (10 CSR 20-7.031)	**Applicable**	Identifies beneficial uses of water to the state, criteria to protect those uses, and defines the anti-degradation policy.	Applicable to all waters of the state.
	Public Drinking Water Program Maximum Volatile Organic Chemical Contaminant Levels and Monitoring Requirements (10 CSR 0-4.100)	**Applicable**	State MCLs have been promulgated for a number of common organic contaminants to regulate the concentration of contaminants in public drinking water supply systems. The regulations are generally equivalent to the Federal SDWA MCLs. State MCLs are applicable for Site groundwater because groundwater in the vicinity is a potential drinking water supply	State MCLs are employed to develop TCLs for the Site groundwater, in those cases where they are stricter than federal standards.
Guidance	U.S. Environmental Protection Agency (EPA) Risk Reference Doses (RfDs)	**To Be Considered**	RfDs are dose levels developed by EPA for evaluating incremental human carcinogenic risk from exposure to carcinogens	RfDs are used to evaluate human health risks from exposure to non-carcinogenic Site contaminants.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	**To Be Considered**	CSFs are developed for evaluating incremental human carcinogenic risk from exposure to carcinogens.	CSFs are used to evaluate cancer risk resulting from exposure to carcinogenic Site COCs.
	EPA Health Advisories, Human Health Risk Assessment Guidance and Ecological Risk Assessment Guidance	**To Be Considered**	These guidance documents and advisories establish criteria and provide guidelines for evaluating human health and ecological risks at CERCLA sites.	These guidance documents and advisories are used to evaluate human health and ecological risk due Site COCs.
	Clean-up Levels for Missouri (CALM) – Appendix B (Tier 1 Soil and Groundwater Cleanup Standards)	**To Be Considered**	Establishes conservatively-derived, risk-based Groundwater Target Concentrations (GTARC) for remediation of voluntary cleanup sites in Missouri.	Although GTARC are non-enforceable guidelines, they may be considered for groundwater in the absence of promulgated MCLs.

Table B-1

Potential Location Specific ARARs and TBCs

Authority	Requirement	Status	Synopsis of Requirement	Consideration in the FS
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990, 40 CFR Part 6, Appendix A)	**Applicable**	Requires federal agencies to minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.	The U.S. Army Corps of Engineers has identified a jurisdictional wetland down-gradient of the Site.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR Part 6, Appendix A)	**Applicable**	Requires federal agencies to evaluate the potential effects of an action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	The potential effects on the Cape La Croix Creek will be considered during the development and evaluation of remedial alternatives. All practicable measures will be taken to limit adverse effects on floodplains.
	Resource Conservation and Recovery Act (RCRA) Floodplain Restriction for Hazardous Facilities (40 CFR 264.18(b))	**Applicable**	A hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent wash-out of any hazardous waste by a 100-year flood, unless the owner or operator can demonstrate that procedures are in effect that will cause the waste to be removed safely before the flood can reach the facility.	If remedial alternatives are developed which include hazardous waste facilities in the floodplain at the Site, then the facilities will need to comply with these requirements.
State Regulatory Requirements	Protection of Lakes and Streams Missouri Water Quality Standards (10 CSR 20-7.03)	**Applicable**	Promulgates rules to protect quality of lakes and streams. Beneficial uses of Cape La Croix Creek are designated as livestock and wildlife watering and protection of warm water and aquatic life and human health (fish consumption).	Chemical specific ARARs are identified in Table B-1.

Table B-2

Potential Action-Specific ARARs and TBCs

Authority	Requirement	Status	Synopsis of Requirement	Consideration in the FS
Federal Regulatory Requirements	Standards Applicable to Transporters of Hazardous Waste (40 CFR Part 263)	**Applicable**	Establishes standards which apply to persons transporting hazardous waste within the United States if the transportation requires a manifest pursuant to 40 CFR part 262.	If alternative involves offsite transportation of hazardous materials.
	Safe Drinking Water Act (SDWA) – §1412(b)(4)(E)(ii)	**Applicable**	Regulates the design, management, and operation of point of use (POU) or point of entry (POE) treatment units used to achieve compliance with a MCL.	If individual wellhead treatment units are required, these units will need to comply.
	Safe Drinking Water Act -- Criteria and procedures for public water systems using point of entry devices (40 CFR §141.100)	**Applicable**	Establishes criteria and procedures for Public Water Systems using POE devices.	If water supply wells are installed in the area which require wellhead treatment.
	Safe Drinking Water Act -- Variances and exemptions from the maximum contaminant levels for organic and inorganic chemicals (40 CFR §142.60)	**Applicable**	Identifies technologies and treatment techniques or other means available to achieve compliance with MCLs.	If wellhead treatment becomes necessary, then the system best available technologies will be needed to attain MCLs.

Table B-3